BIOLOGICAL OPINION SUMMARY
STORM WATER PERMIT FOR THE VERDE VALLEY RANCH

Date of opinion: October 7, 1997

Action agency: Environmental Protection Agency

Project: Issuance of a National Pollutant Discharge Elimination System Storm Water Permit

Location: Yavapai County, Arizona

Listed species affected: Bald eagle (*Haliaeetus leucocephalus*) threatened without critical habitat, peregrine falcon (*Falco peregrinus*) endangered without critical habitat, Mexican spotted owl (*Strix occidentalis lucida*) threatened without critical habitat (since critical habitat for the Mexican spotted owl has been enjoined by New Mexico District Court [Coalition of Arizona-New Mexico Counties for Stable Economic Growth versus USFWS, filed March 4, 1997], no consultation or conference is required), southwestern willow flycatcher (*Empidonax traillii extimus*) endangered with proposed critical habitat, razorback sucker (*Xyrauchen texanus*) with critical habitat, and the Colorado squawfish (*Ptychocheilus lucius*) without critical habitat.

Biological opinion: No jeopardy or adverse modification of critical habitat

Incidental take statement:

Anticipated take: *Exceeding this level may require reinitiation of formal consultation.* The Service concludes that incidental take from the proposed action will be considered to be exceeded if the monitoring data indicate a trend that demonstrates a decline in water quality conditions as compared to the projected mean pollutant concentrations estimated in the proposed Storm Water Pollution Prevention Plan.

Reasonable and prudent measures: *Implementation of these measures through the terms and conditions is mandatory.* One reasonable and prudent measures was given: Full implementation of the storm water management program shall not result in a trend in the decline of water quality conditions as compared to the mean pollutant concentrations estimated in the SWPPP.

Terms and conditions: *Terms and conditions implement reasonable and prudent measures and are mandatory requirements.* Five terms and conditions are given:
1) Conduct stormwater monitoring as specified in the SWPPP, including all monitoring and maintenance requirements. Track the frequency and magnitude of measured levels which exceed the predicted means. Measured levels are not expected to meet or exceed predicted means. 2) Evaluate monitoring data that are higher than the Arizona Water Quality standards. If the permittee is causing or contributing to the exceedance, conduct an investigation to determine the source of the pollutants. 3) Measure the actual contaminants of organics and metals to soil particles. Modify plan to add sediment samples from Tavasci Marsh and the Verde River. 4)

Conduct visual inspections to indicate evidence of a violation of the Arizona Water Quality narrative standards, particularly for oil and grease. 5) Report the results of the monitoring to the Service annually.

Conservation recommendations: *Implementation of conservation recommendations is discretionary.* Two recommendations are given. 1) Coordinate with the Service and the Arizona Game and Fish Department on a project to re-introduce the Page springsnail, *Pyrgulopsis morrisoni*, a candidate species into Tavasci Marsh. 2) 2. Conduct a literature review to acquire, review, and summarize information on the toxic effects of newly paved asphalt as it may relate to the Verde River watershed.

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In Reply Refer To:
AESO/SE
2-21-94-F-309

October 7, 1997

Ms. Alexis Strauss, Acting Director
Water Division
United States Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105-3901

Dear Ms. Strauss:

This responds to your letter to the U.S. Fish and Wildlife Service requesting initiation of formal section 7 consultation under the Endangered Species Act. The consultation concerns the possible effects of your proposed issuance of a National Pollutant Discharge Elimination System (NPDES) Storm Water Permit to Phelps Dodge for the proposed Verde Valley Ranch Development in Yavapai County. The species potentially affected by this action are the bald eagle (*Haliaeetus leucocephalus*) threatened without critical habitat, peregrine falcon (*Falco peregrinus*) endangered without critical habitat, Mexican spotted owl (*Strix occidentalis lucida*) threatened without critical habitat, southwestern willow flycatcher (*Empidonax traillii extimus*) endangered with critical habitat, razorback sucker (*Xyrauchen texanus*) with critical habitat, and the experimental non-essential population of Colorado squawfish (*Ptychocheilus lucius*) without critical habitat. Since critical habitat for the Mexican spotted owl has been enjoined by New Mexico District Court Coalition of Arizona-New Mexico Counties for Stable Economic Growth versus USFWS, No. 95-1285-M Civil, filed March 4, 1997], no consultation or conferencing is required for the preceding designation of critical habitat for the Mexican spotted owl.

Experimental non-essential populations, as is the designation for the Colorado squawfish, are considered for the purposes of section 7, as if they were only proposed for listing as a threatened species. Thus, this document is a combined biological opinion for the listed species and their critical habitat, and a conference report for the experimental non-essential population of the Colorado squawfish.

Your request for formal consultation on this project was received on February 28, 1997. This document represents the Service's biological opinion on the effects of that action on the above mentioned species in accordance with section 7 of the Endangered Species Act of 1973, as amended, (16 U.S.C. 1531 et seq.).

This biological opinion is based on information provided in the August 1996 biological assessment prepared by SWCA, Inc., the December 1995 Storm Water Pollution Prevention plan (SWPPP) for the Verde Valley Ranch prepared by Woodward-Clyde, telephone conversations between members of our staff, field investigations, and other sources of information. References cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file in this office.

It is the Service's biological opinion that the issuance of a National Pollutant Discharge Elimination System Storm Water Permit for the Verde Valley Ranch Development is not likely to jeopardize the continued existence of the endangered razorback sucker, threatened bald eagle, endangered peregrine falcon, threatened Mexican Spotted owl, or endangered southwestern willow flycatcher; nor is this project likely to result in the destruction or adverse modification of critical habitat for the razorback sucker or southwestern willow flycatcher. The Conference Report at the end of this document addresses the experimental nonessential population of the Colorado squawfish.

CONSULTATION HISTORY

On March 7, 1994, EPA sent the Service a general description of the project, the issuance of a storm water permit, and requested informal consultation. Phelps Dodge wrote the Service a letter dated March 17, 1994, stating that they believed the request was premature and therefore inappropriate. There was some question about the need for a separate consultation for the issuance of a storm water permit. No other formal consultations have been issued on individual storm water permits in Arizona. Storm water discharges are authorized under the NPDES, except as limited by Part I.B.3 of the permit which states "...storm water discharges from construction sites if the discharges may adversely affect a listed or proposed to be listed endangered or threatened species or its critical habitat."

This office received a copy of a September 25, 1995, letter from EPA to Leo Pruett of Phelps Dodge Corporation. That letter stated: "In addition, as we both have concluded, a section 7 consultation with the U.S. Fish and Wildlife Service will be required as part of the storm water application process." Further, page 2 of the Response to Conservation Recommendations and Reasonable and Prudent Alternatives for Verde Valley Ranch Section 7 Consultation, submitted by SWCA to Phelps Dodge Corporation in April 1995, stated: "The issue of maintaining water quality at Peck's Lake and the Verde River and control of potential contaminants from stormwater runoff from the proposed development are not detailed in this report. The issue of stormwater runoff is being addressed in a separate evaluation and report as part of the Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES) permit program."

Once the need for the consultation was established, SWCA faxed this office a letter dated July 2, 1996, requesting clarification on the scope of this consultation. On July 30, 1996, the Service sent a letter back to SWCA acknowledging that the direct, indirect, and interdependent

effects of the development had been addressed in the Corps consultation, including the relationship to increases in predation and cowbird parasitism on the southwestern willow flycatcher, and construction of structures not related to storm water management. On September 5, 1996, EPA transmitted the biological assessment prepared by SWCA for Phelps Dodge Development Corporation. In that letter, EPA requested formal consultation. The Service responded with a November 5, 1996, letter stating that due to extreme workloads, we would be unable to proceed with this consultation until early in calendar year 1997. On February 4, 1997, the Service sent EPA a letter stating that we were ready to proceed with the consultation. We requested additional clarification on potential effects to the Arizona cliffrose (*Purshia subintegra*). The Service received an addendum dated February 24, 1997, to the September 5, 1996, biological assessment containing the additional information on the Arizona cliffrose, concluded no effect to the cliffrose, and again requested initiation of formal consultation on the remaining species. The species of concern listed in your September 5, 1996 letter include the bald eagle, peregrine falcon, Mexican spotted owl, southwestern willow flycatcher with proposed critical habitat at the that time but has since been finalized, razorback sucker with critical habitat, and the Colorado squawfish. The 90-day consultation period began on February 28, 1997, the date your request was received by the Arizona Ecological Services Field Office. Notice of that receipt was sent to you in a memorandum dated March 24, 1997. On April 2, 1997, the Service received a letter from the Mayor of Clarkdale concerned about our scheduled due date. After re-evaluating office work priorities, the Service sent a letter back to the Mayor of Clarkdale stating that we would expedite the consultation and submit a draft opinion to EPA by June 3, 1997. EPA responded to the draft biological opinion on July 24, 1997. Additional comments were received by Phelps Dodge, who EPA designated as an applicant in this biological opinion, as well as two consulting firms SWCA and Woodward-Clyde, and the law firm of Gallagher & Kennedy on behalf of Phelps Dodge. Additional conference calls, review drafts, and meetings occurred with the goal of finalizing this document.

A separate consultation was conducted between the Service and Corps of Engineers on a predischarge notice for permit PDN-93-682-RD on the Verde Valley Ranch Development. The Service received a request for formal consultation from the Corps on October 5, 1993. The Service issued a draft biological opinion on February 24, 1994. The Service received a letter from the Corps with comments from Phelps Dodge Corporation on April 7, 1994. The Service issued a nonjeopardy biological on April 18, 1994, for the razorback sucker, bald eagle, and the experimental non-essential population of the Colorado squawfish. That opinion also concluded no effect to the peregrine falcon, Arizona cliffrose, spikedace, and Mexican spotted owl.

A draft conference report was also issued to the Corps (March 3, 1994) with a draft jeopardy/adverse modification for the southwestern willow flycatcher, and a nonjeopardy to the proposed critical habitat for the razorback sucker. A final opinion on the southwestern willow flycatcher was issued to the Corps on February 27, 1996, which concluded jeopardy to the species and adverse modification of the proposed critical habitat. The final opinion presented a Reasonable and Prudent Alternative and is being implemented.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The action under consideration is the issuance of a National Pollutant Discharge Elimination System storm water permit for the Phelps Dodge Development Verde Valley Ranch project which includes a 1,200 home residential area, an 18 hole golf course, and a small commercial area. Section 402(p) of the Clean Water Act authorizes a General Storm Water Permit for Discharges from construction sites. Exemptions from this General Permit include construction sites that are likely to adversely affect a listed or proposed species or its critical habitat. In a letter to Phelps Dodge dated April 28, 1995, EPA determined that the project may affect listed species and requested an individual storm water permit.

This individual storm water permit authorizes three water bodies to receive storm water runoff from the proposed development. Peck's Lake will receive the majority of the runoff (218 acre-feet in a year of average rainfall), followed by Tavasci Marsh (24 acre-feet), with the Verde River projected to receive the least amount of runoff (7.4 acre-feet). Facilities to be constructed under this permit include building pads, curb and gutter, pavement, landscaping, and golf course construction. The process for receiving, treating, and discharging the storm water runoff is described in a SWPPP prepared by Woodward-Clyde Consultants. The existing copper tailings pond will be capped and covered by the golf course. An integrated turf management program to limit the use of fertilizers and pesticides on the golf course is detailed in Appendix G of the biological assessment. Some key points of the plans include prohibiting direct drainage into Peck's Lake from high maintenance turf areas, using pesticides use will be on a curative basis, and constructing a permanent berm between the golf course and Peck's Lake to reduce runoff potential. Detailed descriptions of the construction and monitoring plans, roads, drainage patterns, and other aspects of storm water management may also be found in the Storm Water Pollution Prevent Plan (Woodward Clyde 1995).

Over a 12-month period, construction will also include the construction of the tailings cap, two pump stations, grading of roads and residential areas into parcels, a permanent water storage reservoir, trenched (underground) utility lines, a new lake outlet structure, temporary and permanent effluent storage ponds, grading and landscaping of the golf course, and landscaping of primary access roads. During construction, runoff will be directed away from disturbed areas by temporary berms, earth dikes, and other means.

DESCRIPTION OF THE PROJECT AREA

The 977 acre (395 hectare) Verde Valley Ranch site is a proposed master planned community in Clarkdale, in Yavapai County, near Tuzigoot National Monument. The proposed project consists of a 1,200 home residential area, an 18 hole golf course, and a small commercial area. The existing copper tailings pond will be capped and covered by a golf course.

The proposed Verde Valley Ranch development occurs primarily on the east side of the Verde River, but a portion at the northern end would also occur on the west bank. The 98 acre (39.6

ha) Peck's Lake and the 30 acre (12 ha) Tavasci Marsh also will receive storm water discharge. Peck's Lake currently receives water from the Verde River at an average rate of 9 cubic feet per second. Water from the river enters Peck's Lake through a gate at one side of the lake and flows out into Tavasci Marsh at the other end of the lake. This inflow outflow pattern results in the river flushing the lake approximately every 16 days. The northern portion of the project area joins the Verde River Greenway with Tavasci Marsh and associated riparian areas. The purpose of the greenway, which includes the Verde River 100-year floodplain from Tuzigoot Bridge, six miles (9.6 kilometers) downstream to the Bridgeport Bridge, is to conserve and enhance the river ecosystem while accommodating educational and recreational opportunities.

STATUS OF THE SPECIES

Species Descriptions

Bald eagle

The bald eagle is a large raptor once found throughout North America near seacoasts, lakes, and rivers. Bald eagles usually nest in trees near these bodies of water. The primary food is fish, taken live or as carrion. The bald eagle was first listed as an endangered species on March 11, 1967. Chemical contamination caused chiefly by organochlorine pesticides resulted in reproductive failure and direct toxicity and led to severe population declines and local extirpation throughout the species' range. Habitat loss, persecution, and disturbance also endanger the bald eagle. No critical habitat has been designated for this species.

While bald eagles in the southwest were initially considered a distinct population, the final rule for their downlisting to a threatened species notes that the Service has determined that bald eagles in the southwestern recovery region are part of the same bald eagle population found in the remaining lower 48 states. Southwestern eagles show a high level of genetic heterozygosity; however, because it could not be demonstrated that Arizona bald eagles are a part of a larger population, Hunt *et al.* (1992) initially concluded that it was prudent to assume reproductive isolation. However, in 1994, a male bald eagle originating in eastern Texas was discovered breeding at Luna Lake in northeastern Arizona. The origin of the unmarked female was undeterminable. It is also suspected that some of the silver-banded birds observed in Arizona in recent years may have immigrated into this population. This new information indicates that the bald eagles of central Arizona are not reproductively isolated, as was previously believed. The southwestern bald eagles are also unusual behaviorally in that they frequently nest on cliffs; a phenomenon rare outside this geographic region. The southwestern bald eagle nests early, with eggs laid in January or February. This is believed to be a behavioral adaptation to avoid the extreme desert heat of midsummer. The young eagles remain in the vicinity of the nest until June (Hunt *et al.* 1992).

Arizona has 36 known breeding areas (BA) (pers. comm., G.L. Beatty, Arizona Game and Fish Department). In 1995 and 1996, 30 of the breeding areas in Arizona were occupied with each BA supporting one nesting pair. The majority of the population within Arizona is distributed

along the Salt, Verde, Gila, and Bill Williams Rivers, as well as several major tributaries. Although many of the threats to bald eagles in this region persist, the population appears to be stable or increasing. The bald eagle, including the southwestern bald eagle population was downlisted to threatened on August 11, 1995 (USFWS 1995a).

The bald eagle has made substantial progress toward recovery. However, even though the species appears to be increasing, bald eagles are increasingly exposed to hazards from a regionally expanding human population. These include extensive loss and modification of riparian breeding and foraging habitat through clearing, changes in groundwater levels and hydrographs, and changes in water quality, and increasing human disturbance from urban, rural and recreational encroachment into breeding habitat. This latter threat includes a host of activities documented by Stahlmaster (1987) such as shooting, collision with vehicles, aircraft, transmission lines and structures, poisoning, and electrocution.

The bald eagle population in the Southwest was probably never very large due to limited habitat, and in pre-industrial times likely fluctuated in size in response to weather conditions (e.g. cyclic droughts and wet periods). Following the banning of domestic use of the pesticide DDT in 1972, the Arizona bald eagle population has probably increased despite growing pressures of a regionally increasing human population and associated industrialization. However, while significant recovery has taken place, the bald eagle remains somewhat tenuously established in the Southwest. Various reports and records suggest that nesting bald eagles may have been more widely distributed in Arizona in the past. Historic site records suggest the presence of bald eagle nest sites not known to have been occupied in the last decade (Hunt *et al.* 1992). These observations may suggest that there are factors that are currently limiting further recovery or population expansion.

Peregrine falcon

The American peregrine falcon was listed as an endangered species on October 13, 1970 (35 FR 16047). No critical habitat has been designated for this species. The peregrine falcon is a medium-sized raptor with various subspecies distributed worldwide. The American peregrine falcon occurs across much of North America. It nests on cliffs near sources of avian prey. The peregrine falcon has traditionally been strongly associated with cliffs near large bodies of water such as seacoasts, lakes, and large rivers (Ratcliffe 1980). However, the arid American southwest has recently been demonstrated to support the largest concentration of peregrines known in North America, excluding Alaska. Studies have documented high densities of breeding pairs in the Southwest, particularly the Colorado Plateau Province (Burnham and Enderson 1987, Hays and Tibbitts 1989, Tibbitts and Bibles 1990, Brown 1991). Local concentrations of nesting pairs have also been documented in the mountains of southeastern Arizona (Tibbitts and Ward 1990a and 1990b, Berner and Mannan 1992, Ward 1993).

In the Southwest, breeding peregrines are currently found almost anywhere large (approximately $\geq$100 meters) cliffs are available, with the exception of the hottest and driest desert regions (Tibbitts and Ward 1990a, Ward 1993, USDI unpubl. data). Large cliffs overlooking chaparral,

pinyon-juniper woodland, conifer forest, and riparian habitats apparently provide high-quality habitat. These cliffs are currently occupied by breeding pairs almost wherever they occur in Arizona and southern Utah, even where surface water may be many miles distant. Even in the Sonoran desert, peregrine falcons may be found breeding where perennial surface water and associated riparian prey populations are available.

The American peregrine falcon appears to be making considerable progress toward recovery throughout much of its range. On June 30, 1995, the Service published an advance notice of a proposal to remove the American peregrine falcon from the list of endangered and threatened wildlife, stating that data currently on file with the Service indicate that this subspecies has recovered following restrictions on the use of organochlorine pesticides in the United States and Canada and because of management activities including the reintroduction of captive-bred peregrine falcons (60 FR 34406).

Peregrines feed almost exclusively upon other birds, such as shorebirds, pigeons, doves, robins, flickers, jays, swifts, swallows, and other passerines that opportunity presents (Craig 1986). Although some individuals may become adept hunters, it is estimated that peregrine succeed in making kills only 10 to 40 percent of the time (Roalkvam 1985, Cade 1982). The falcons compensate for this inefficiency by traveling extensively when hunting. During the breeding season, a hunting range of 10 miles (16 km) may be considered typical (Craig 1986). Proximity of a cliff to surface water may affect occupancy. In Arizona, nearly all nest sites which are great distances from extensive permanent water have nearby permanent water sources; rivers lakes and streams are the most important sources (Ellis 1982).

The Peregrine Falcon Recovery Plan for the Southwest Population (USFWS 1984) recommends against land-use practices and development which adversely alters or eliminates the character of hunting habitat or prey base within 10 miles (16 km) of an eyrie, and within 1 mile (1.6 km) of the nesting cliff.

The degree of disturbance that peregrine falcons can tolerate is generally believed to be a function of the magnitude of the disturbance, the distance from the breeding site, and the falcon's habituation to human activities. Raptors in frequent contact with human activities tend to be less sensitive to additional disturbances than raptors nesting in remote areas. However, exposure to direct human harassment may make raptors more sensitive to disturbances (Newton 1979). Where prey is abundant, raptors may even occupy areas of high human activity, such as cities and airports (Newton 1979, Ratcliffe 1980, White *et al.* 1988). The timing, frequency, and predictability of the disturbance may also be factors. Raptors become less sensitive to human disturbance as their nesting cycle progresses (Newton 1979). Generally, peregrine falcons are least tolerant of disturbance during the prelaying through incubation periods. After young are hatched, peregrines exhibit considerably higher levels of tolerance and are unlikely to abandon the nesting attempt (Cade 1960, Cade and White 1976, Fyfe and Olendorff 1976, Eberhardt and Skaggs 1977, Olsen and Olsen 1978, Monk 1980, Roseneau *et al.* 1981).

Exposure to direct human harassment may make raptors more sensitive to disturbances (Newton 1979). Construction activities, operation of heavy machinery, and aircraft activity, all with the notable absence of direct human harassment, were generally tolerated by nesting peregrine falcons and gyrfalcons (Platt 1977, Ellis 1981, Haugh 1982, White and Thurow 1985, Ritchie 1987, White *et al.* 1988). Peregrines have nested in situations where there is a high level of disturbance, such as on buildings in urban settings (Cade and Bird 1990). Cade and Bird (1990) discussed the possible effects on peregrines of high levels of human activity, including noise and machinery such as compressors, blowing fans, and bright night lighting. They concluded that the effects were unknown. Apparently, responses vary considerably within and among species.

Recovery of the peregrine falcon in the Rocky Mountain/Southwest region appears to be greatest in the Colorado Plateau of southern Utah, southwest Colorado, and northern Arizona, and in adjacent habitats in Arizona, Utah and Colorado. This region has experienced high total numbers of breeding pairs, high rates of site occupancy and high reproductive success (Burnham and Enderson 1987, Enderson *et al.* 1991, Tibbitts and Bibles 1990, Tibbitts and Ward 1990a and 1990b, Ward 1993). Based on 1994 surveys, the current Rocky Mountain/Southwest population consists of 559 breeding pairs, surpassing the recovery objective by 376 pairs (FR 60:34406-34409).

Mexican spotted owl

A detailed account of the taxonomy, biology, and reproductive characteristics of the Mexican spotted owl is found in the Final Rule listing the Mexican spotted owl as a threatened species (58 FR:14248) and in the Final Mexican spotted owl Recovery Plan (USFWS 1995b). The information provided in those documents is included herein by reference.

Although the Mexican spotted owl's entire range covers a broad area of the southwestern United States and Mexico, much remains unknown about the species' distribution and ecology. This is especially true in Mexico where much of the Mexican spotted owl's range has not been surveyed. The Mexican spotted owl currently occupies a broad geographic area but does not occur uniformly throughout its range. Instead, it occurs in disjunct localities that correspond to forested isolated mountain systems, canyons, and in some cases, steep, rocky canyon lands. The primary administrator of lands supporting Mexican spotted owl in the United States is the U.S. Forest Service. Most owls have been found within Forest Service Region 3 (including 11 National Forest in Arizona and New Mexico). According to the Recovery Plan, 91% of Mexican spotted owl known to exist in the U.S. between 1990 and 1993 occurred on lands administered by the Forest Service.

Surveys have revealed that the species has an affinity for older, well-structured forest, and the species is known to inhabit a physically diverse landscape in the southwestern United States and Mexico. A reliable estimate of the absolute numbers of Mexican spotted owl throughout its entire range is not available (USFWS 1995b) and the quality and quantity of information regarding numbers of Mexican spotted owl vary by source. USFWS (1991) reported a total of 2,160 owls throughout the United States. Fletcher (1990) calculated that 2,074 owls existed in

Arizona and New Mexico. Spotted owls may occur on the Mongollon Rim or Mingus Mountains, 10 to 15 miles (16 to 24 km) from the project, but no individuals are known from the project area.

Southwestern willow flycatcher

The southwestern willow flycatcher is a small passerine bird measuring approximately 15 centimeters (5.75 in.) in length from the tip of the bill to the tip of the tail and weighing only 11 grams (0.4 ounces). It has a grayish-green back and wings, whitish throat, light gray-olive breast, and pale yellowish belly. Two white wingbars are visible (juveniles have buffy wingbars). The eye ring is faint or absent. The upper mandible is dark, the lower is light yellow grading to black at the tip.

The southwestern willow flycatcher is an insectivore typically perching on a branch and making short direct flights, or sallying, to capture flying insects. The southwestern willow flycatcher is a riparian obligate, nesting along rivers, streams, and other wetlands where dense growths of willow (*Salix* sp.), *Baccharis*, buttonbush (*Cephalanthus* sp.), boxelder (*Acer negundo*), saltcedar (*Tamarix* sp.) or other plants are present, often with a scattered overstory of cottonwood (*Populus* sp.) and/or willow.

One of four currently-recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993), the southwestern willow flycatcher is a neotropical migratory species that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Tudor 1994, Howell and Webb 1995). The historical range of the southwestern willow flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

The States of California and New Mexico list the southwestern willow flycatcher as endangered (California Department of Fish and Game 1992, and New Mexico Department of Game and Fish 1988). The State of Arizona considers the southwestern willow flycatcher a species of special concern (AGFD 1996). The Service included the southwestern willow flycatcher on its Animal Notice of Review as a category 2 candidate species on January 6, 1989 (USFWS 1989). A proposal to list the southwestern willow flycatcher as endangered, with critical habitat, was published on July 23, 1993 (USFWS 1993), and a final rule without critical habitat was published on February 27, 1995 (USFWS 1995c), becoming effective on March 29, 1995. Following the review of comments received during the public comment period, the Service deferred the designation of critical habitat, invoking an extension on this decision until July 23, 1995. A moratorium on listing actions under the Act passed by Congress in April 1995 required the Service to cease work on the designation of critical habitat. On April 26, 1996, the moratorium was lifted and on May 16, 1996, the Service published a notice in the Federal Register announcing listing prioritization guidance. Listing actions were placed in categories of decreasing order of priority: Tier 1 - Emergency listings; Tier 2 - Finalization of listing

decisions on proposed species; and Tier 3 - all other listing actions (proposed rules, petition findings, critical habitat designations). On May 13, 1997, the Southwest Center for Biological Diversity filed a lawsuit claiming that the Service violated the Act by not finalizing critical habitat for the southwestern willow flycatcher. On March 20, 1997, the District Court ordered the Service to finalize critical habitat for the flycatcher by July 18, 1997. As ordered, the final rule designating critical habitat was published on July 18, 1997, and became effective on August 21, 1997. A correction notice was published in the Federal Register on August 20, 1997.

Life History

The southwestern willow flycatcher forages within and above dense riparian vegetation, taking insects on the wing or gleaning them from foliage (Wheelock 1912, Bent 1960). No information is available on specific prey species. However, fecal samples containing identifiable invertebrate body parts were collected during banding operations from more than 70 southwestern willow flycatchers in California, Arizona, and southwestern Colorado (M. Sogge, USGS, pers. comm.). These samples could yield important data on prey use at various locations and timing throughout the breeding season.

The southwestern willow flycatcher begins arriving on breeding grounds in late April and May (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Maynard 1995, Sferra *et al.* 1995). Migration routes are not completely known. However, willow flycatchers have been documented migrating through specific locations and drainages in Arizona that do not currently support breeding populations, including the upper San Pedro River (BLM, unpubl. data), Colorado River through Grand Canyon National Park (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994), lower Colorado River (Muiznieks *et al.* 1994, Spencer *et al.* 1996), Verde River tributaries (Muiznieks *et al.* 1994), and Cienega Creek (BLM, *in litt.*). These observation *E.t. adastus*. *Empidonax* flycatchers rarely sing during fall migration, so that a means of distinguishing some migrating *Empidonax* without a specimen is not feasible (Blake 1953, Peterson and Chalif 1973). However, willow flycatchers have been reported to sing and defend winter territories in Mexico and Central America (Gorski 1969, McCabe 1991).

Nesting begins in late May and early June and young fledge from late June through mid-August (Willard 1912, Ligon 1961, Brown 1988, Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Whitfield 1994, Maynard 1995). Southwestern willow flycatchers typically lay three to four eggs in a clutch (range is from two to five). The breeding cycle, from laying of the first egg to fledgling, is approximately 28 days. Eggs are laid at one-day intervals (Bent 1960, Walkinshaw 1966, McCabe 1991); they are incubated by the female for approximately 12 days; and young fledge approximately 12 to 13 days after hatching (King 1955, Harrison 1979). Southwestern willow flycatchers typically raise one brood per year but have been documented raising two broods during one season (Whitfield 1990). They have also been documented renesting after nest failure (Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Whitfield 1994, Whitfield and Strong 1995).

Whitfield, who has accumulated the largest data set on southwestern willow flycatchers, reported the following data on survivorship of adults and young: of 58 nestlings banded since 1993, 21 (36%) returned to breed; of 57 birds banded as adults (after hatch year) since 1989, 18 (31%) returned to breed at least one year (10 males, 8 females); five (9%) returned to breed for two years (all males); and two (3.5%) returned to breed for three years (M. Whitfield, Kern River Preserve, pers. comm.). Whitfield (1995) also documented statistically significant variation in return rates of juveniles as a function of fledgling date; approximately 21.9% of juveniles fledged on or before July 20th returned to her study area the following year, whereas only 6.4% of juveniles fledged after July 20th returned the following year.

Walkinshaw (1966), who studied *E.t. traillii* in Michigan, estimated that 40.9% of the males at his study site returned to breed for at least two years, 22.7% returned for at least three years, 13.6% returned for at least four years, and at least 4.5% returned during their fifth year. Female return rates were substantially lower. Only 22.6% returned to breed for one year. Whitfield and Walkinshaw do not incorporate potential emigration rates into their estimates of returns and, thus, may underestimate actual survivorship. However, these data are consistent with survival rates for other passerines (Gill 1990), life span of most southwestern willow flycatchers is probably two to three years (i.e. most flycatchers survive to breed one or two seasons).

Brood parasitism of southwestern willow flycatcher nests by the brown-headed cowbird (*Molothrus ater*) has been documented throughout the flycatcher's range (Brown 1988, Whitfield 1990, Muiznieks *et al.* 1994, Whitfield 1994, Hull and Parker 1995, Maynard 1995, Sferra *et al.* 1995, Sogge 1995b). Cowbirds lay their eggs in the nests of other species directly affecting their hosts by reducing nest success. Cowbird parasitism reduces host nest success in several ways. Cowbirds may remove some of the host's eggs, reducing overall fecundity. Hosts may abandon parasitized nests and attempt to renest, which can result in reduced clutch sizes, delayed fledgling, and reduced overall nesting success and fledgling survivorship (Whitfield 1994, Whitfield and Strong 1995). Cowbird eggs, which require a shorter incubation period than those of many passerine hosts, hatch earlier giving cowbird nestlings a competitive advantage over the host's young for parental care (Bent 1960, McGeen 1972, Mayfield 1977, Brittingham and Temple 1983). Where studied, high rates of cowbird parasitism have coincided with southwestern willow flycatcher population declines (Whitfield 1994, Sogge 1995a, Sogge 1995c, Whitfield and Strong 1995), or, at a minimum, resulted in reduced or complete elimination of nesting success (Muiznieks *et al.* 1994, Whitfield 1994, Maynard 1995, Sferra *et al.* 1995, Sogge 1995a, Sogge 1995c, Whitfield and Strong 1995). Whitfield and Strong (1995) found that flycatcher nestlings fledged after July 20th had a significantly lower return rate and that cowbird parasitism was often the cause of delayed fledgling.

Habitat Use

The southwestern willow flycatcher breeds in dense riparian habitats from sea level in California to over 2133 m (7000 feet) in Arizona and southwestern Colorado. Throughout its wide geographic and elevational range, its riparian habitat can be broadly described based on plant

species composition and habitat structure (Sogge *et al.* 1997). These attributes are among the most conspicuous components of flycatcher habitat but not necessarily the only important components. They are easily identified from photographs or during field visits and have been useful in conceptualizing, selecting, and evaluating suitable survey habitat. Photographs and accompanying text provided in Sogge *et al.* (1997) characterize the considerable variation in habitat structure and plant species composition found at breeding sites throughout the southwestern willow flycatcher's range. Two components that vary less across this subspecies' range are vegetation density and the presence of surface water. Those and other characteristics, such as size and shape of habitat patches, are described further below.

Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher. Those types are described below and should be referenced with photographs provided in Sogge *et al.* (1997). When reviewing the habitat descriptions below and applying them to a particular location in the field, keep in mind that characteristics of actual breeding sites fall somewhere on a continuum from monotypic to multiple plant species, and from a relatively simple habitat structure characterized by a single vegetation stratum to more complex habitat patches characterized by multiple-strata.

Monotypic willow: Nearly monotypic, dense stands of willow (often *S. exigua* or *S. geyeriana*) 3 to 7 m in height with no distinct overstory layer; usually very dense structure in at least lower 2 m; live foliage density is high from the ground to canopy.

Monotypic exotic: Nearly monotypic, dense stands of exotics such as saltcedar (*Tamarisk* sp.) or Russian olive (*Elaeagnus angustifolia*) 4 to 10 m in height forming a nearly continuous, closed canopy (with no distinct canopy layer); lower 2 m may be very difficult to penetrate due to branch density; however live foliage volume may be relatively low from 1 to 2 m above ground; canopy density uniformly high.

Native broadleaf dominated: Comprised of dense stands of single species (often Goodding's or other willows) or mixtures of native broadleaf trees and shrubs including, but not limited to, cottonwood, willows, boxelder, ash, buttonbush, and stinging nettle from 4 to 15 m in height; characterized by trees of different size classes; may have distinct overstory of cottonwood, willow or other broadleaf species, with recognizable subcanopy layers and a dense understory of mixed species; exotic/introduced species may be a rare component, particularly in understory.

Mixed native/exotic: Dense mixtures of native broadleaf trees and shrubs (such as those listed above) mixed with exotic species such as tamarisk and Russian olive; exotics are often primarily in the understory, but may also be a component of overstory; the native and exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat; overall, a particular site may be dominated primarily by natives, exotics, or be a more or less equal mixture.

There are other potentially important dimensions or characteristics of southwestern willow flycatcher habitat, including: size, shape, and distribution of vegetation patches; hydrology; prey types and abundance; humidity); and interspecific competition. Underlying these are factors relating to population dynamics, such as demography (i.e. birth and death rates, age-specific fecundity), the distribution of breeding groups across the landscape, flycatcher dispersal patterns, migration routes, site fidelity, philopatry, and degree of conspecific sociality (e.g. coloniality). Most of these attributes are not well understood for the southwestern willow flycatcher. However, some of these factors may be critical to understanding current population dynamics and habitat use. For example, characterizations of suitable breeding habitat may be significantly biased if observed patterns of habitat use are influenced by intrinsic dispersal patterns and capabilities rather than overall habitat quality.

Ultimately, habitat suitability should be measured in terms of reproductive success and survivorship that result in a positive rate of population growth. Without long-term data that correlate or experimentally verify which combination of the above attributes contribute to population growth, habitat descriptions should be viewed broadly and considered descriptors of "suitable survey habitat."

The size and shape of occupied riparian habitat patches vary considerably. Southwestern willow flycatchers have been found nesting in patches as small as 0.8 ha (e.g. Grand Canyon) and as large as several hundred hectares (e.g. Roosevelt Lake, Lake Mead). When viewed from above, the mixed vegetation types in particular often appear as a mosaic of plant species and patch shapes and sizes. In contrast, narrow, linear riparian habitats one or two trees wide do not appear to contain attributes attractive to nesting flycatchers. However, flycatchers have been found using these habitats during migration.

Nest placement and nesting substrate

Southwestern willow flycatcher nests are open cup structures, approximately 8 cm high and 8 cm wide (outside dimensions), exclusive of any dangling material at the bottom. Nests are typically placed in the fork of a branch with the nest cup supported by several small-diameter vertical stems. The main branch from which the fork originates may be oriented vertically, horizontally, or at an angle, and stem diameter for the main supporting branch can be as small as three to four cm. Vertical stems supporting the nest cup are typically one to two cm in diameter. Occasionally, southwestern willow flycatchers place their nests at the juncture of stems from separate plants, sometimes different plant species. Those nests are also characterized by vertically-oriented stems supporting the nest cup. Spencer *et al.* (1996) measured the distance between flycatcher nests and shrub/tree center for 38 nests in monotypic saltcedar and mixed native broadleaf/saltcedar habitats. In monotypic saltcedar stands (n=31), nest placement varied from 0.0 m (center stem of shrub or tree) to 2.5 m. In the mixed riparian habitat (n=7), nest placement varied from 0.0 to 3.3 m.

Nest height relative to the base of nest substrate also varies across the southwestern willow flycatcher's range and may be correlated with height of nest substrate and/or overall canopy

height. Table x1 presents data on nest heights in different riparian habitat types across the flycatcher's range. Southwestern willow flycatcher nests have been found as low as 0.6 m above the ground to 14 m above the ground. The data presented in Table x1 demonstrate that flycatchers using predominantly native broadleaf riparian habitats nest relatively low to the ground (between 1.8 m and 2.1 m on average), whereas those using mixed native/exotic and monotypic exotic riparian habitats nest relatively high above the ground (between 4.3 m and 7.4 m on average).

Historic egg/nest collections and species' descriptions from throughout the southwestern willow flycatcher's range confirm the bird's widespread use of willow for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, T. Huels *in litt.* 1993, San Diego Natural History Museum 1995). Of the 34 nests found by Brown in 1902 near Yuma on the lower Colorado and Gila rivers, 33 were in Goodding's willow and one was in arrowweed. Data from historic egg collections from southern California and more current studies indicate that 75 to 80% of nests were placed in willows (San Diego Natural History Museum 1995).

Currently, southwestern willow flycatchers use a wide variety of plant species for nesting substrates. At the monotypic willow stands that characterize high elevation sites in Arizona, Geyer willow was used almost exclusively for nesting (Muiznieks *et al.* 1994). At the inflow to Lake Mead on the Colorado River, Goodding's willow was the primary nesting substrate (R. McKernan unpubl. data). Along a 20-mile (32 km) stretch of the Gila River in Grant County, New Mexico, where boxelder is the dominant understory species, 76% of flycatcher nests were placed in boxelder, with the remainder in Russian olive and saltcedar (Skaggs 1995). At the inflows of Tonto Creek and Salt River to Roosevelt Lake in Gila County, Arizona, both of which are comprised of monotypic stands of saltcedar, 100% of flycatcher nests were placed in saltcedar (Muiznieks *et al.* 1994, Sferra *et al.* 1995, Spencer *et al.* 1996). On the San Luis Rey River in San Diego County, California, approximately 90% of flycatcher nests were placed in live oak (*Quercus agrifolia*), which became the dominant plant species adjacent to the stream after willows were removed in the 1950s as a water conservation measure and a reservoir upstream reduced flood frequency and streamflow volume (W. Haas, San Diego Natural History Museum, pers. comm., 1995). Other plant species that southwestern willow flycatcher nests have been documented in include: buttonbush, black twinberry (*Lonicera involucrata*), Fremont cottonwood, white alder (*Alnus rhombifolia*), blackberry (*rubus ursinus*), Russian olive, and *S. hindsiana*.

Territory size

Southwestern willow flycatcher territory size, as defined by song locations of territorial birds, probably changes with population density, habitat quality, and nesting stage. Early in the season, territorial flycatchers may move several hundred meters between singing locations (Sogge *et al.* 1995, Petterson and Sogge 1996). It is not known whether these movements represent polyterritorial behavior or active defense of the entire area encompassed by singing locations. However, during incubation and nestling phases territory size, or at least the activity

Table x1. Nest height and nest substrate height data by riparian habitat type for the southwestern willow flycatcher.

Habitat Type	Mean Nest Ht. Relative to Base of Nest Substrate [m]	n	Mean Nest Substrate Height [m] ± 1 STD (range)	± 1 STD (range)	Source
Monotypic stands of Geyer willow (Apache Co., AZ)		33	1.8 ±0.3 (1.0 - 2.3)	4.4 ±0.5 (3.5 - 6.0) Spencer *et al.* (1996, 1997)	Muiznieks *et al.* (1994), Sferra *et al.* (1995)
Mixed native broadleaf, predominantly Goodding's willow (Yuma Co., AZ)		28	2.1 ±0.8 (1.2 - 4.9)	-	H. Brown 1902 collections (T. Huels *in litt.*)
Mixed native broadleaf (Kern Co., CA)		134	2.1 ±0.1 (0.6 - 10)	5.6 ±0.3 (1 - 14)	Whitfield and Strong (1995)
Mixed native broadleaf/saltcedar (throughout AZ)		70	4.8 ±1.8 (1.5 - 10.5)	7.4 ±2.3 (3.5 - 17.0) Spencer *et al.* (1996, 1997)	Muiznieks *et al.* (1994), Sferra *et al.* (1995)
Mixed native broadleaf/exotic (Grant Co., NM)		45	7.4 ±3.6 (2.0 - 14)	12.7 ±5.2 (4 - 28)	Skaggs (1995)
Monotypic saltcedar (throughout AZ)		43	4.3 ±1.3 (2.7 - 8.0)	7.7 ±2.0 (3.4 - 12.0) Spencer *et al.* (1996, 1997)	Muiznieks *et al.* (1994), Sferra *et al.* (1995)

centers of pairs, can be very small and restricted to an area less than one-half hectare. Sogge *et al.* 1995 estimated a breeding territory size of 0.2 ha for a pair of flycatchers occupying a 0.6 ha patch on the Colorado River. Activity centers may expand after young are fledged but while still dependent on adults.

Distribution and abundance

Unitt (1987) noted that taxonomic confusion between *E. traillii* and *E. alnorum* (alder flycatcher) and among other *Empidonax* species that migrate through the southwestern U.S. probably accounted for the relative lack of research on the southwestern willow flycatcher. The alder and willow flycatchers, formerly known as Traill's flycatcher, were not officially recognized as separate species until the American Ornithologist's Union published its sixth edition Checklist of North American Birds (AOU 1983). The lack of systematic, rangewide collections of southwestern willow flycatchers preclude a complete description of this subspecies' former distribution and abundance. However, the more than 600 egg, nest, and specimen records available from museums throughout the U.S. in combination with state, county, and local faunal accounts from the first half of the 20th Century indicate that, historically, the southwestern willow flycatcher was more widespread and, at least, locally abundant.

Phillips (1948) first described *E.t. extimus* from a specimen collected by Gale Monson on the lower San Pedro River near Feldman, AZ. The taxonomic validity of *E.t. extimus* was subsequently reviewed by Hubbard (1987), Unitt (1987), and Browning (1993), and has been accepted by most authors (e.g., Aldrich 1951, Behle and Higgins 1959, Phillips *et al.* 1964, Oberholser 1974, Monson and Phillips 1981, Harris *et al.* 1987, Schlorff 1990, Harris 1991). Unitt (1987) reviewed historical and contemporary records of *E.t. extimus* throughout its range, determining that it had "declined precipitously..." and that although the data reveal no trend in the past few years, the population is clearly much smaller now responsible for the decline seem likely.

Overall, Unitt (1987) documented the loss of more than 70 breeding locations rangewide, including locations along the periphery and within core drainages that form this subspecies' range. Unitt estimated that, rangewide, the southwestern willow flycatcher population probably was comprised of 500 to 1000 pairs. Below is a state by state comparison of historic and current data for the southwestern willow flycatcher. Since 1992 more than 800 historic and new locations have been surveyed rangewide to document the status of the southwestern willow flycatcher (some sites in southern California have been surveyed since the late 1980s). Survey efforts in most states were done under the auspices of the Partners In Flight program, which served as the coordinating body for survey training sessions and review and synthesis of data. The extensive and, in some cases, intensive nature of these efforts have provided a critical baseline for the current distribution, abundance, and reproductive success of southwestern willow flycatchers rangewide.

California

The historic range of southwestern willow flycatchers in California apparently included all lowland riparian areas in the southern third of the state. It was considered a common breeder where suitable habitat existed (Wheelock 1912, Willett 1912, 1933, Grinnel and Miller 1944). Unitt (1984, 1987) concluded that it was once common in the Los Angeles basin, the San Bernardino/Riverside area, and San Diego County. Specimen and egg/nest collections confirm its former distribution in all coastal counties from San Diego Co. to San Luis Obispo Co., as well as in the inland counties, Kern, Inyo, Mohave, San Bernardino, and Imperial. Unitt (1987) documented that the flycatcher had been extirpated, or virtually extirpated (i.e., few territories remaining) from the Santa Clara River (Ventura Co.), Los Angeles River (Los Angeles Co.), Santa Ana River (Orange and Riverside counties), San Diego River (San Diego Co) Lower Colorado River (Imperial and Riverside counties and adjacent counties in AZ), Owen's River (Inyo Co.), and the Mohave River (San Bernardino Co.). Its former abundance in California is evident from the 72 egg and nest sets collected in Los Angeles County, alone, between 1890 and 1912, and from Herbert Brown's 34 nests and nine specimens taken in June of 1902 from the lower Colorado river near Yuma. Local collections of this magnitude suggest that this subspecies was locally very abundant.

Survey and monitoring efforts since the late 1980s have confirmed the southwestern willow flycatcher's presence at 18 locations on 11 drainages in southern California (including Colorado River). Current known flycatcher breeding sites are restricted to three counties, San Diego, Riverside, Santa Barbara, and Kern. Combining survey data for all sites surveyed since the late 1980s for a composite population estimate, the total known southwestern willow flycatcher population in southern California is 114 territories (Table x2). Of the 18 sites where flycatchers have been documented, 72% (13) contain five or fewer territorial flycatchers; 22% (four sites) have single pairs, or unmated territorial birds. Only three drainages are known to have 20 or more flycatcher territories, the San Luis Rey River (San Diego Co.), South Fork Kern River (Kern Co.), and Santa Ynez River (Santa Barbara Co.).

Authorized (permitted) and unauthorized activities in riparian habitats continue to adversely affect occupied flycatcher habitat in southern California. For example, approximately one km of occupied habitat on the Santa Ynez River in Santa Barbara County was modified or completely eliminated in 1996 when expansion of agricultural fields resulted in clearing of riparian vegetation (USFWS *in litt.*). Despite the vast potential for riparian habitat and southwestern willow flycatcher recovery on Camp Pendleton in San Diego County, a programmatic section 7 consultation resulted in a conservation target of 20 southwestern willow Table x3). The Base currently has approximately 22 pairs of flycatchers, in contrast to the 348 pairs of the sympatric and endangered least Bell's vireo (*Vireo bellii pusillus*), which through the Base's conservation efforts increased from a low of 27 pairs in 1984. Army Corps of Engineers operations of Lake Isabella (Kern County) will result in long-term inundation of the 485-ha South Fork Wildlife Area, also critical habitat for the flycatcher.

Table x2. Rangewide population status for the southwestern willow flycatcher (based on composite of 1993-1995 survey data and 1996 survey data from lower Colorado River)[1].

	No. of Sites with Territories	No of. Drainages with Territories	No. of Sites (Drainages) with ≤5 Territories	with 6-20 Territories	with >20 Territories	Total No. of Territories
New Mexico	19	8	16 (6)	2 (0)	1 (2)	173
Arizona	39	9	29 (4)	10 (4)	0 (2)	150
California	18	11	13 (8)	3 (1)	2 (3)	114
Colorado	6	5	6 (5)	0 (0)	0 (0)	13
Utah	2	1	2 (1)	0 (0)	0 (0)	2
Nevada	1	1	1 (1)	0 (0)	0 (0)	2
Texas	?	?	?	?	?	?
Total	85	35	67 (24)	15 (4)	3 (7)	454

1 Based on surveys conducted at >800 historic and new sites in NM (Maynard 1995, Cooper 1996, Skaggs 1996); AZ (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Sogge and Tibbitts 1994, Sferra *et al.* 1995, Sogge 1995a, Sogge *et al.* 1995, Spencer *et al.* 1996, 1997, McKernan *in litt.*); CA (Camp Pendleton 1994, Whitfield 1994, Griffith and Griffith 1995, Holmgren and Collins 1995, Kus 1995, San Diego Natural History Museum 1995, Whitfield and Strong 1995, Griffith and Griffith 1996 *in litt.*); CO (T. Ireland 1994 *in litt.*, Stransky 1995); UT (McDonald *et al.* 1995, Sogge 1995b); NV (C. Tomlinson 1995 *in litt.*). Systematic surveys have not been conducted in Texas. For sites surveyed multiple years, highest single-year estimate of territories was used to tabulate status data. Tabulations do not include documented extirpations within survey period. Thus, individual state estimates and rangewide totals may be biased upward.

Table x3. Agency actions that have undergone section 7 consultation and levels of incidental take permitted for the southwestern willow flycatcher rangewide.

Action	Federal Year	Agency[1]	Incidental Take Anticipated
Arizona			
Eastern Roosevelt Lake Watershed Allotment (Maricopa Co.)	1995*	Tonto NF	Indeterminable
Tonto Creek Riparian Unit (Maricopa Co.)	1995*	Tonto NF	Indeterminable
Cedar Bench Allotment (Yavapai Co.)	1995	Tonto NF	Indeterminable
Tuzigoot Bridge (Yavapai Co.)	1995*	NPS	None
Verde Valley Ranch (Yavapai Co.)	1995*	Corps	Loss of 2 flycatcher territories
Windmill Allotment (Yavapai Co.)	1995	Coconino NF	Loss of 1 flycatcher nest annually
Romero Road Bridge (Pinal Co.)	1995*	FEMA	Consultation in process
Glen Canyon Spike Flow (Coconino Co.)	1996	USBR	Adverse modification of proposed critical habitat
Solomon Bridge (Graham Co.)	1996*	FHWA	Loss of 2 territories
Modified Roosevelt Dam (Gila/Maricopa Co.)	1996*	USBR	Loss of 45 territories; reduced productivity/survivorship 90 birds
U.S. Hwy 93 Wickenburg (Mohave Co.)	1996*	FHWA	Reduced productivity of 3 territories annually for 2 years
Grazing on 13 Allotments (Pinal Co.)	1996	BLM	Consultation in process
Lower Gila Resource Plan Amend. (Yuma Co.)	1996	BLM	Consultation in process
Lower Colorado River Operations	1996*	USBR	Consultation in process
U.S. Forest Service Region 3 Forest Plans	1996	USFS	Consultation in process
Safford District Grazing Allotments	1996	BLM	Consultation in process
Virgin River Diversion/Fill (Mohave Co.)	1997	EPA	None
California			
Prado Basin, (Riverside/San Bernardino Co.)	1994	Corps	None
Orange County Water District (Orange Co.)	1995	Corps	None
Temescal Wash Bridge (Riverside Co.)	1995	Corps	Harm to 2 flycatchers
Camp Pendleton (San Diego Co.)	1995	DOD	Loss of 4 flycatcher territories
Lake Isabella Operations 1996 (Kern Co.)	1996*	Corps	Inundation 700 ac proposed critical habitat; reduced productivity 14 pairs
Lake Isabella Long-Term Operations (Kern Co.)	1997*	Corps	Consultation in process
Nevada			
Gold Properties Resort (Clark Co.)	1995	BIA	Harm to 1 flycatcher from habitat loss

Table x3 (continued).

Action	Federal Year	Agency[1]	Incidental Take Anticipated
New Mexico			
Corrales Unit, Rio Grande (Bernalillo Co.)	1995	Corps	None
Rio Puerco Resource Area	1996	BLM	Consultation in process
Farmington District Resource Management Plan	1996*	BLM	Consultation in process
Mimbres Resource Area Management Plan	1996*	BLM	Consultation in process

[1] BIA = Bureau of Indian Affairs; BLM = Bureau of Land Management; Corps = Army Corps of Engineers; DOD = Dept. of Defense; EPA = Environmental Protection Agency; FEMA = Federal Emergency Management Agency; FHWA = Federal Highway Administration; NF = National Forest; NPS = National Park Service; USBR = U.S. Bureau of Reclamation; USFS = U.S. Forest Service.

* Original proposed action determined to result in jeopardy to the flycatcher and/or adverse modification of proposed critical habitat.

The Wildlife Area represents a significant recovery area occupied by 8 to 10 pairs of flycatchers prior to inundation and lies downstream of one of California's largest southwestern willow flycatcher breeding groups on the Kern River Preserve.

Arizona

Historic records for Arizona indicate the former range of the southwestern willow flycatcher included portions of all major river systems (Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro) and major tributaries, such as the Little Colorado River and headwaters, and White River. Unitt (1987) noted that "probably the steepest decline in the population levels of *extimus* has occurred in Arizona." The bird has been extirpated, or virtually extirpated from the Santa Cruz River (Pima Co.), upper San Pedro River (Cochise Co.), lower San Pedro River at PZ Ranch (Pinal Co.), Blue River (Greenlee Co.), Colorado River at Lees Ferry (Coconino Co.), Colorado River (Yuma Co.), Gila River (Yuma Co.), and Verde River at Tuzigoot Bridge (Yavapai Co.). Currently, 150 territories are known from 39 sites along nine drainages statewide, including the Colorado River (Table x2). As in California, the majority of breeding groups in Arizona are extremely small; of the 39 sites where flycatchers have been documented, 74% (29) contain five or fewer territorial flycatchers. Moreover, 15 to 18% of all sites in Arizona are comprised of single, unmated territorial birds.

Permitted activities and stochastic events also continue to adversely affect the distribution and extent of occupied and potential breeding habitat throughout Arizona. For example, the Bureau of Reclamation is operating the new conservation space at Roosevelt Lake, which at capacity would totally inundate the riparian stands occupied by Arizona's largest breeding group (Table x3). As a result of Reclamation's operations on the lower Colorado River, the 445-ha Goodding's willow stand at the inflow to Lake Mead has been partially inundated since September 1995. Despite partial inundation, approximately eight pairs of flycatchers were documented nesting at the inflow during the 1996 breeding season. As of April 1997, inundation of that habitat was nearly complete. Reclamation (1996) projected the mortality of that stand sometime during 1997 as a result of prolonged inundation of root crowns (i.e. > two growing seasons).

In June of 1996, a catastrophic fire destroyed approximately one km of occupied habitat on the San Pedro River in Pinal County. That fire resulted in the forced dispersal or loss of up to 8 pairs of flycatchers (Paxton *et al.* 1996). In June of 1995, approximately 4.8 km of occupied riparian habitat burned on the Gila River in Pinal County (Bureau of Land Management *in litt.*). It is not known how many flycatchers occupied that location. Approximately two km of riparian habitat burned in Graham County in the vicinity of Safford during 1996. It is not known whether that area was occupied by southwestern willow flycatchers, however, it did lie just downstream of an occupied patch that was partially eliminated by Solomon Bridge (Table x3). The anticipated effect of construction of the Solomon Bridge was dispersal of flycatchers into adjacent habitat. The capability of adjacent habitat to absorb that dispersal was compromised by the fire near Safford.

New Mexico

Unitt (1987) considered New Mexico as the state with the greatest number of *extimus* remaining. After reviewing the historic status of the flycatcher and its riparian habitat in New Mexico, Hubbard (1987) concluded,

> [it] is virtually inescapable that a decrease has occurred in the population of breeding willow flycatchers in New Mexico over historic time. This is based on the fact that wooded sloughs and similar habitats have been widely eliminated along streams in New Mexico, largely as a result of the activities of man in the area.

Unitt (1987), Hubbard (1987), and more recent survey efforts have documented extirpation or virtual extirpation in New Mexico on the San Juan River (San Juan Co.), near Zuni (McKinley Co.), Blue Water Creek (Cibola Co.), Rio Grande (Dona Ana Co. and Socorro Co.). Survey and monitoring efforts since 1993 have documented 173 flycatcher territories on eight drainages (Table x2). Approximately 135 of these territories occur in remnant strips of riparian forest within a 20-mile stretch of the Gila River in Grant Co (Skaggs 1995). This area contains the largest known breeding group rangewide. In a letter responding to proposed critical habitat for the flycatcher, this part of the Gila River is characterized as being contained by flood-control levees that do not support the regeneration of riparian trees such as willow and cottonwood. Thus, under existing conditions, habitat suitable for the southwestern willow flycatcher is not regenerating (Apker, writ. comm. 1995) and this largest population may be lost as a result. Outside of Grant County few flycatchers remain. Statewide, 84% (16) of the 19 sites with flycatchers contain five or fewer territorial birds. Six sites are comprised of single pairs or unmated territorial flycatchers, and six others are comprised of two pairs or two unmated territorial birds.

Texas

The Pecos and Rio Grande rivers in western Texas are considered the easternmost boundary for the southwestern willow flycatcher. Unitt (1987) found specimens from four locations in Brewster, Hudspeth, and Loving counties where the subspecies is no longer believed to be present. Landowner permission to survey riparian areas on private property has not been obtained, thus current, systematic survey data is not available for Texas. There have been no other recent reports, anecdotal or incidental, of southwestern willow flycatcher breeding attempts in the portion of western Texas where they occurred historically. Given that surveys in adjacent Dona Ana County, New Mexico, have failed to document breeding along historically-occupied portions of the Rio Grande, the Service believes it is likely that the southwestern willow flycatcher has been extirpated from Texas.

Colorado

The taxonomic status and the historic distribution and abundance of willow flycatchers in southwestern Colorado remains unclear due to a lack of specimen data and breeding records.

Preliminary data on song dialects suggests that the few birds recently documented in southwestern Colorado may be *E.t. extimus*. These sightings have prompted State and Federal agencies to delineate provisional boundaries for southwestern willow flycatchers and sponsor statewide survey efforts. Survey efforts since 1993 have documented a total of six locations in Delta, Mesa, and San Miguel counties where southwestern willow flycatchers have been found (Table x2). Two locations have single, unmated males; two locations have single pairs, and the remaining two locations are comprised of four to seven territories each.

On March 9, 1997, a fire started by an adjacent landowner burned a 32-ha portion of the Escalante Wildlife near Delta, Colorado. That location comprised one of the largest known breeding sites for southwestern willow flycatchers in Colorado with approximately seven pairs occupying the site in 1996.

Utah

Specimen data reveal that southwestern willow flycatcher historically occurred in southern Utah along the Colorado River, San Juan River, Kanab Creek, Virgin River, and Santa Clara River (Unitt 1987). Their northern boundary in south-central Utah remains unclear due to a lack of specimen data from that region. The southwestern willow flycatcher no longer occurs along the Colorado River in Glen Canyon where Lake Powell inundated historically-occupied habitat, nor in unflooded portions of Glen Canyon near Lee's Ferry (Arizona) where southwestern willow flycatchers were documented nesting in 1938. Similarly, recent surveys on the Virgin River and tributaries and Kanab Creek have failed to document their presence (McDonald *et al.* 1995). Single, territorial males and possibly a pair of southwestern willow flycatchers were documented at two locations on the San Juan River (San Juan Co.) in 1995, but breeding was not confirmed (Sogge 1995b). The population totals for Utah are summarized in Table x2.

Nevada

Unitt (1987) documented three locations in Clark County from which southwestern willow flycatchers had been collected, but not found after 1970. Current survey efforts have documented a single location with two unmated males on the Virgin River in Clark County (Tomlinson *in litt.*) (Table x2).

Rangewide, the current known population of southwestern willow flycatchers stands at approximately 454 territories (Table x2). These results indicate a critical population status; more than 75% of the locations where flycatchers have been found are comprised of five or fewer territorial birds and up to 20% of the locations are comprised of single, unmated individuals. The distribution of breeding groups is highly fragmented, with groups often separated by considerable distances (e.g., approximately 88 km straight-line distance between breeding flycatchers at Roosevelt Lake, Gila Co., AZ, and the next closest breeding groups known on either the San Pedro River (Pinal Co.) or Verde River (Yavapai Co.)). Additional survey effort, particularly in southern California, may discover additional small breeding groups. However, rangewide survey efforts have yielded positive results in less than 10% of surveyed locations.

Moreover, survey results reveal a consistent pattern rangewide: the southwestern willow flycatcher population as a whole is comprised of extremely small, widely-separated breeding groups or unmated individuals.

The data presented in Table x2 represents a composite of surveys conducted since 1992. Locations that had southwestern willow flycatchers for only one year were tabulated as if the location is still extant. Given that extirpation has been documented at several locations during the survey period, this method of analyses introduces a bias that may overestimate the number of breeding groups and overall population size. In addition, females have been documented singing as frequently as males. Because the established survey method relies on singing birds as the entity defining a territory (Tibbitts *et al.* 1994), double-counting may be another source of sampling error that biases population estimates upward. The figure of 454 southwestern willow flycatcher territories is an approximation based on considerable survey effort, both extensive and intensive. Given sampling errors that may bias population estimates positively or negatively (e.g., incomplete survey effort, double-counting males/females, composite tabulation methodology), natural population fluctuation, and random events, it is likely that the total population of southwestern willow flycatchers is fluctuating at between 300 and 500 territories with a substantial proportion of individuals remaining unmated. If all extant sites were fully protected, at such low population levels random demographic, environmental, and genetic events could lead to extirpation of breeding groups and eventually render this species extinct. The high proportion of unmated individuals documented during recent survey efforts suggests the southwestern willow flycatcher may already be subject to a combination of these factors (e.g., uneven sex ratios, low probability of finding mates in a highly fragmented landscape).

Southwestern willow flycatcher reproductive success

Intensive nest monitoring efforts in California, Arizona, and New Mexico have revealed that: (1) sites with both relatively large and small numbers of pairs have experienced extremely high rates of brood parasitism; (2) high levels of cowbird parasitism in combination with nest loss due to predation have resulted in low reproductive success and, in some cases, population declines; (3) at some sites, levels of cowbird parasitism remain high across years, while at others parasitism varies temporally with cowbirds absent in some years; (4) the probability of a southwestern willow flycatcher successfully fledgling its own young from a nest that has been parasitized by cowbirds is low (i.e., $< 5\%$); (5) cowbird parasitism and/or nest loss due to predation often result in reduced fecundity in subsequent nesting attempts, delayed fledgling, and reduced survivorship of late-fledged young, and; (6) nest loss due to predation appears more constant from year to year and across sites, generally in the range of 30 to 50%.

On the South Fork Kern River (Kern Co., CA), Whitfield (1993) documented a precipitous decline in the southwestern willow flycatcher breeding population from 1989 to 1993 (from 44 to 27 pairs). During that same period cowbird parasitism rates between 50 and 80 % were also documented (Whitfield 1993) (Table x4). A cowbird trapping program initiated in 1993 reduced cowbird parasitism rates to $< 20\%$. Southwestern willow flycatcher population numbers appear to have stabilized at 32 to 34 pairs in 1993, 1994, and 1995 (Whitfield 1994, Whitfield and

Table x4. Nest predation and brood parasitism rates documented for the southwestern willow flycatcher across its range[1].

Location	Pre-1993	1993	1994	1995
S. Fork Kern River (Kern Co., CA)				
% nests parasitized[2]	50 - 80	38*	16*	19*
% nests depredated	33 - 42	37	47	34
San Luis Rey River (San Diego Co. CA)				
% nests parasitized	-	-*	0*	0*
% nests depredated	-	-	28	5
Colorado River (Coconino Co., AZ)				
% nests parasitized	≥50	100	44	100
% nests depredated	-	30	78	0
Verde River (Yavapai Co., AZ)				
% nests parasitized	-	100	50	extirpated
% nests depredated	-	100	50	
Little Colorado River (Apache Co., AZ)				
% nests parasitized	-	-	22	0
% nests depredated	-	-	33	28
Rio Grande (Socorro Co., NM)				
% nests parasitized	-	-	20	66
% nests depredated	-	-	40	60
Gila River (Grant Co., NM)				
% nests parasitized	-	-	-	16 - 27
*				
% nests depredated	-	-	-	45

[1] Sources: Sogge and Tibbitts (1992), Sogge *et al.* (1993), Brown (1994), Maynard 1994, Muiznieks *et al.*(1994), Sogge and Tibbitts (1994), Cooper (1995), Skaggs (1995), Sogge (1995a), Sogge *et al.* (1995), Spencer *et al.* (1995), Whitfield and Strong (1995).

[2] Proportion of nests containing at least one brown-headed cowbird egg.

* Brown-headed cowbird control program implemented.

Strong 1995). Predation rates have remained relatively constant in the range of 33 to 47% (Table x4). Southwestern willow flycatcher nest success increased from 26% prior to cowbird trapping to 48% after trapping was implemented (Whitfield and Strong 1995). In addition, the number of young fledged also increased from 1.01 young/pair to 1.73 young/pair during the same period.

Whitfield and Strong (1995) found that, besides lowering nest success, fecundity, and the number of young produced, cowbird parasitism may also lower survivorship of southwestern willow flycatcher young fledged late in the season. Southwestern willow flycatchers that abandon parasitized nests or renest after fledgling cowbirds lay fewer eggs in subsequent clutches and, if successful, fledge young late in the season. Whitfield and Strong (1995) determined that cowbird parasitism delayed successful southwestern willow flycatcher nesting by at least 13 days and this delay resulted in significantly different return rates of juveniles. Only 6.4% of southwestern willow flycatcher young that came from late nests were recaptured in subsequent years, whereas 21.9% of young that came from early nests were recaptured. If these recapture rates mirror actual survivorship, then even though some parasitized southwestern willow flycatchers eventually fledge their own young, nest loss due to parasitism or depredation may have the more insidious effect of reducing overall juvenile survivorship. Despite the cowbird trapping program and increased reproductive success, a population increase has not observed at the study area. Whitfield and Strong (1995) speculate that other factors in addition to cowbird parasitism, such as habitat loss and pesticide use on wintering grounds and/or stochastic events such as storms resulting in mortality, may be keeping population numbers low.

The number of unmated, territorial, and paired southwestern willow flycatchers detected on the Colorado River in the Grand Canyon has remained low since monitoring began in 1982. Brown (1994) reported that at least 50% of the southwestern willow flycatcher nests monitored in the Grand Canyon between 1982 and 1987 were parasitized by brown-headed cowbirds. Brown (1994) did not report data on productivity. Given that the probability of successfully fledgling a single chick is low when a nest is parasitized and the high proportion of nests parasitized during Brown's study, it is likely that southwestern willow flycatcher productivity during that period was also low. In 1992, when comprehensive nest monitoring was initiated, two pairs were present, with only one establishing a nest. That nest successfully fledged three chicks (Sogge and Tibbitts 1992).

In 1993, one breeding pair, one male with two females, and six unpaired males were detected. Three nests were found, all of which were parasitized by brown-headed cowbirds (Table x4). No southwestern willow flycatchers were successfully reared in Grand Canyon in 1993 (Sogge *et al.* 1993). Four pairs and one unpaired male occupied Grand Canyon in 1994. Nine nests were attempted, at least four of which were parasitized by cowbirds. All nesting attempts eventually failed due to predation or abandonment (Sogge and Tibbitts 1994). In 1995, one breeding pair and three unpaired males were detected (Sogge *et al.* 1995). One nest was found with a single cowbird egg on May 23. On June 4, three southwestern willow flycatcher eggs were present, but the cowbird egg was missing. That nest successfully fledged one chick. In summary, since 1992, 10 known pairs of southwestern willow flycatchers have made 14 nesting

attempts in the Grand Canyon, two of which successfully fledged a total of four chicks. This low rate of reproduction indicates that, even with the protections provided annually by the National Park Service (i.e., camping and other activities are prohibited at southwestern willow flycatcher breeding sites), this area is a population sink (Pulliam 1988) where reproduction is not adequate to replace adults and population persistence requires emigration from other breeding areas.

On the Verde River in Yavapai Co., AZ, Ohmart (pers. comm.) discovered four pairs of southwestern willow flycatchers in 1992 at Clarkdale. The breeding status and reproductive success of those birds was not determined. In 1993, two pairs were present and one nest was documented. The nest contained a single cowbird nestling and eventually failed (Muiznieks *et al.* 1994) (Table x4). In 1994, two pairs and one unpaired male were present. Two nests were found, one of which successfully fledged two chicks, the other fledged a single cowbird (Sferra *et al.* 1995). Data from a more limited monitoring effort in 1995 indicate that two unpaired males occupied the Clarkdale site (Sogge 1995a). Surveys during the 1996 breeding season failed to detect any southwestern willow flycatchers at the Clarkdale site. However, one nesting pair was discovered at Tavasci Marsh approximately 2.4 km east of the Clarkdale site. Thus, although since its discovery the Clarkdale site has had only several pairs, cowbird parasitism and nest loss due to depredation resulted in poor reproductive success and may have been responsible for abandonment or extirpation at this site.

Elsewhere in Arizona, population loss or undetected dispersal of breeding groups has been documented since 1993. For example, surveys in 1993 estimated five territorial males at Dudleyville Crossing on the San Pedro River (Pinal Co.). However, surveys in 1994 and 1995 failed to detect any southwestern willow flycatchers at that location (Muiznieks *et al.* 1994, Sferra *et al.* 1995, Spencer *et al.* 1996). Southwestern willow flycatchers detected in 1993 at Soza Wash on the San Pedro River were not detected in follow-up surveys in 1995, and an individual observed at Ister Flat on the Verde River was not detected in follow-up surveys during 1994. It is not known whether these events represent mortality of southwestern willow flycatchers, changes in habitat quality, or simply a wandering tendency inherent to this species. At other locations on the San Pedro River in Pinal Co., such as Cook's Lake and PZ Ranch, southwestern willow flycatcher breeding group size has remained stable. However, in 1996 a catastrophic fire destroyed much of the breeding habitat at PZ Ranch resulting in nest loss, abandonment of that site and, perhaps, mortality of adults (Paxton *et al.* 1996).

On the Little Colorado River in Apache Co., AZ, a cowbird parasitism rate of 22% was documented in 1994 (Table x4). In 1995 the parasitism rate was zero. Nest loss due to depredation, however, remained relatively constant (Table x4). On the Rio Grande in Socorro Co., NM, parasitism rates increased from 20% in 1994 to 66% in 1995. In 1996, water was diverted above that breeding location and no southwestern willow flycatchers were present (D.Leal, USFWS, pers. comm.). It is not known whether those birds dispersed elsewhere or if that breeding group was extirpated. Finally, on the Gila River in Grant Co., NM, Skaggs (1995) monitored 46 nests from a breeding group of approximately 135 pairs. From a subset

of 25 nests whose contents were checked directly or inferred through observation, Skaggs estimated a cowbird parasitism rate of between 16 and 27% for 1995 (Table x4).

The data presented above and in Table x4 demonstrate that cowbird parasitism and nest depredation are affecting southwestern willow flycatchers throughout their range. Cowbirds have been documented at more than 90% of sites surveyed (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Camp Pendleton 1996, Muiznieks *et al.* 1994, Sogge and Tibbitts 1994, T. Ireland 1994 *in litt.*, Whitfield 1994, C. Tomlinson 1995 *in litt.*, Griffith and Griffith 1995, Holmgren and Collins 1995, Kus 1995, Maynard 1995, McDonald *et al.* 1995, Sferra *et al.* 1995, Sogge 1995, 1996, San Diego Natural History Museum 1995, Stransky 1995, Whitfield and Strong 1995, Griffith and Griffith 1996 *in litt.*, Skaggs 1995, Spencer *et al.* 1996. Thus, the potential for cowbirds to be a persistent and widespread threat remains high. Cowbird trapping has been demonstrated to be an effective management strategy for increasing reproductive success for the southwestern willow flycatcher as well as for other endangered Passerines (e.g., least Bell's vireo [*Vireo bellii pusillus*], black-capped vireo [*V. atricapillus*], golden-cheeked warbler [*Dendroica chrysoparia*]). It may also benefit juvenile survivorship by increasing the probability that parents fledge birds early in the season. Expansion of cowbird management programs has the potential to not only increase reproductive output and juvenile survivorship at source populations, but also to potentially convert small, sink populations into breeding groups that contribute to population growth and expansion.

Nest loss due to predation is common among small Passerines. The rates documented for southwestern willow flycatchers are also typical for small Passerines (i.e., rates $< 50\%$). However, even at these "typical" levels nest loss due to predation is a significant factor contributing to low reproductive success. Nest predation presents a difficult management challenge because of the variety of taxa involved and the difficulty in developing an effective management plan for more than one taxon. Until specific predators on southwestern willow flycatcher nests are identified, measures to reduce potential predator populations should focus on reducing human activities that attract predators, such as camping, picnicking, etc. where pets are loose and refuse is concentrated.

Razorback sucker

The razorback sucker was first proposed for listing on April 24, 1978, as a threatened species. The proposed rule was withdrawn on May 27, 1980, due to changes to the listing process included in the 1978 amendments to the ESA; the amendments required all listings to be completed within two years of publication of the proposed rule and that deadline was not met. The 1978 amendments also required that critical habitat be included in the listing of most species; however, no critical habitat package had been developed for the proposed listing of the species.

In March 1989, the Service was petitioned to list the razorback sucker as an endangered species. The Service made a positive finding on the petition in June 1989, that was published in the Federal Register on August 15, 1989. The finding stated that a status review was in progress and provided for submission of additional information through December 15, 1989. The

proposed rule to list the species as endangered was published on May 22, 1990, and the final rule was published on October 23, 1991, with an effective date of November 22, 1991.

In the final rule to list the razorback sucker as endangered, the Service stated that critical habitat was not determinable at the time of listing. This gave the Service an additional year to obtain further habitat information. On October 30, 1991, the Service received a notice of intent to sue from the Sierra Club Legal Defense Fund over failure to designate critical habitat at the time of listing. After review of additional information available, the Service concluded on December 6, 1991, that designation of critical habitat was both determinable and prudent. The proposed rule was published on January 29, 1993. The final rule was published on March 21, 1994, with an effective date of April 20, 1994. Critical habitat included portions of the Colorado, Duchesne, Green, Gunnison, San Juan, White and Yampa Rivers in the Upper Colorado River Basin, and the Colorado, Gila, Salt, and Verde Rivers in the Lower Colorado River Basin. All critical habitat reaches were considered to be occupied by the species at the time of the designation.

The razorback sucker is the only representative of the genus *Xyrauchen* and was described from specimens taken from the "Colorado and New Rivers" (Abbott 1861) and Gila River (Kirsch 1888) in Arizona. This native sucker is distinguished from all other suckers by the sharp edged, bony keel that rises abruptly behind the head. The body is robust with a short and deep caudal peduncle (Bestgen 1990). The razorback sucker may reach lengths of one meter and weigh five to six kilograms (Minckley 1973) and are a long lived species, reaching the age of at least the mid-40's (McCarthy and Minckley 1987).

Life history information for the razorback sucker was recently summarized in the status review for the species (Bestgen 1990), in *Battle Against Extinction: Native Fish Management in the American West* (Minckley and Deacon 1991), and in the biological support document for critical habitat designation (Maddux *et al.* 1993). The life history information presented in this biological opinion is primarily taken from these sources.

The razorback sucker was once abundant in the Colorado River and its major tributaries throughout the Colorado River Basin, occupying 3,500 miles (5632 km) of river in the United States and Mexico (Maddux *et al.* 1993). Records from the late 1800's and early 1900's indicated the species was abundant in the lower Colorado and Gila River drainages (Kirsch 1889, Gilbert and Scofield 1898, Minckley 1973, Bestgen 1990).

Adult razorback suckers utilize most of the available riverine habitats, although there may be an avoidance of whitewater type habitats. Main channel habitats used tend to be low velocity ones such as pools, eddies, nearshore runs, and channels associated with sand or gravel bars (summarized in Bestgen 1990). Backwaters, oxbows, and sloughs were well-used habitat areas adjacent to the main channel; flooded bottomlands are important to the species in the spring and early summer (summarized in Bestgen 1990). Razorback suckers are somewhat sedentary, however considerable movement over a year has been noted in several studies (Maddux *et al.* 1993). Spawning migrations have been observed or inferred in several locales (Jordan 1891, Minckley 1973, Osmundson and Kaeding 1989, Bestgen 1990, Tyus and Karp 1990).

Spawning takes place in the late winter to early summer depending upon local water temperatures. Various studies have presented a range of water temperatures at which spawning occurs. In general, temperatures between 10° and 20° centigrade are appropriate for spawning (summarized in Bestgen 1990). Spawning areas include gravel bars or rocky runs in the main channel (Tyus and Karp 1990), and flooded bottomlands (Osmundson and Kaeding 1989). There is an increased use of higher velocity waters in the spring, although this is countered by the movements into warmer, shallower backwaters and inundated bottomlands in early summer (McAda and Wydoski 1980, Tyus and Karp 1989, Osmundson and Kaeding 1989).

Habitat needs of larval razorback suckers are not well known. Warm, shallow water appears to be important. Shallow shorelines, backwaters, inundated bottomlands and similar areas have been identified as nursery habitats (Sigler and Miller 1963, Marsh and Minckley 1989, Tyus and Karp 1989, 1990, Minckley *et al.* 1991). For the first period of life, larval razorback suckers are nocturnal and hide during the day. Diet during this period is mostly plankton (Marsh and Langhorst 1988, Papoulias 1988). Young fish grow fairly quickly, with growth slowing once adult size is reached (McCarty and Minckley 1987). Little is known about habitat preferences of juvenile razorback suckers.

The razorback sucker is adapted to the widely fluctuating physical environments characteristic of rivers in the pre-settlement Colorado River Basin. Adults can live 45-50 years and, once reaching maturity between two and seven years of age (Minckley 1983), apparently produce viable gametes even when quite old. The ability of razorback suckers to spawn in a variety of habitats, flows and over a long season are also survival adaptations. In the event of several consecutive years with little or no recruitment (due to either too much or too little water), the demographics of the population as a whole might shift, but future reproduction would not be compromised. Average fecundity recorded in studies ranged from 46,740 to 100,800 eggs per female (Bestgen 1990). With a varying age of maturity, and the fecundity of the species, it would be possible to quickly repopulate after a catastrophic loss of adults.

The razorback sucker was listed as an endangered species due to declining or extirpated populations throughout the range of the species. The causes of these declines are changes to the biological and physical features of the habitats. The effects of these changes have been most clearly noted by the almost complete lack of natural recruitment to any population in the historic range of the species. Populations are generally small and composed of aging adults.

Recovery efforts under the Recovery Implementation Program in the Upper Colorado River Basin have begun but significant recovery results have net yet been achieved. In the Lower Colorado River Basin, efforts to reintroduce the species to the Gila, Salt and Verde Rivers have not been successful in establishing self-sustaining populations. Reintroduction efforts continue in the Verde River. Augmentation programs along the lower Colorado River are working to replace the aging razorback sucker populations in Lakes Havasu and Mohave with young fish from protected-site rearing programs. These activities may prevent the imminent extinction of the species in the wild, but appear less capable of ensuring long-term survival or recovery. Overall, the status of the razorback sucker in the wild continues to decline.

ENVIRONMENTAL BASELINE

The environmental baseline serves to define the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation. While it is clearly focused on conditions in the action area, it is important to include in the environmental baseline the status of the listed species throughout its range as well as in the action area. Any evaluation of the effects of the action must be made in the context of the overall status of each affected species.

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process.

The Verde River has been subject to new and ongoing Federal, State and private actions. Flood control projects, water diversions, recreation, livestock grazing are some of the human related activities that have affected the Verde River watershed. Sullivan and Richardson (1993) provide an account of the aquatic and riparian habitats of the Verde River including the project area.

When Peck's Lake was created in 1920 by the construction of a diversion dam and Brewer's Tunnel, the main use of the lake was recreation. Currently, the Eurasiona milfoil (*Myriophylum spicatum*), an emergent plant, regularly clogs the lake during the summer months rendering it unusable (Sullivan and Richardson 1993). In 1925 a golf course was built adjacent to the lake. In preparation of the Verde Valley Ranch Development, the golf course was closed in 1992.

Once under consideration for inclusion in the federal Superfund Program (Comprehensive Environmental Response Compensation and Liability Act, CERCLA, of 1980), the project area contains a 129 acre (52 ha) inactive copper tailings impoundment. The copper mine was in operation between 1923 and 1953. Since 1980, the Clarkdale Wastewater Treatment Plant has been disposing of the effluent on to the copper tailings pile. Seepage from the tailings pile has impacted the shallow aquifer with high levels of sulfate and dissolved solids in the Verde River.

Groundwater contamination is believed to be limited to a shallow aquifer and has not impacted the regional drinking water aquifer underlying the tailing pile. The shallow aquifer is impacted by high levels of sulfate, magnesium, total dissolved solids, and low levels of metals (i.e. zinc, cadmium, copper, iron, manganese, and arsenic). High arsenic levels are believed to occur naturally from the Verde Formation, a soft, sedimentary deposit. Mining might play an indirect role in increasing arsenic concentrations by increasing the hydrologic interaction between the Verde River and the Verde Formation (ADEQ 1996a).

The State of Arizona's Aquifer Protection Permit for this project was issued in conjunction with the reclamation of the tailings impoundment adjacent to Peck's Lake with the following conditions, which will be implemented with this project and are considered part of the baseline information. The following conditions are required with the permit:

1. cease discharging effluent from municipal Clarkdale Wastewater treatment plant to the tailings pile and build a new treatment plant;
2. cap and underdrain the tailings pile;
3. construct a soil-bentonite slurry wall between Peck's Lake and the pile; and
4. operate a groundwater pumpback system to stop the seepage of contaminated groundwater currently discharging into the Verde River.

The Aquifer Protection Permit regulations and statues require that facilities not cause or contribute to a violation of Aquifer Water Quality Standards at an applicable point of compliance or does not cause further degradation with respect to pollutants that already exceed standards. The law does not state that leaching must not occur, because in some cases it may be advantageous as long as standards are met at the point of compliance (ADEQ 1995).

Bald Eagle

Within the State of Arizona, eagle breeding sites face continually increasing threats, especially near population centers, from malicious and accidental harassment, including shooting, off-road vehicles, low aircraft overflights, loss of nesting and foraging habitat from riparian degradation, and lethal entanglement in fishline as documented by Hunt *et al.* (1992) and by AGFD (G. Beatty, AGFD, pers. comm.). Twelve nest sites are known for the Verde River from Perkinsville to Orme. Many of Arizona's known breeding areas, including those on located in the Verde drainage are located on rivers and near reservoirs that are easily and frequently accessed by the public. The Arizona Bald Eagle Nestwatch Program (ABENWP) continues to document disturbance at nest sites and frequently intervenes to reduce harassment. This intervention has proven not only effective but perhaps crucial in maintaining the southwestern population. Up to 50 % of a given year's reproduction has been salvaged by ABENWP "rescue" operations including removal of fishline and tackle from nestlings and the return of nestlings to nests after they have fallen or left in response to disturbance or to escape extreme heat. Beatty and Driscoll (1996) estimate 32 wintering bald eagles were supported by the Verde River during the 1996 winter count. King *et al.* (1991) report that fish used by bald eagles collected in the Verde River contained elevated levels of cooper, chromium, mercury, nickel, selenium, and zinc.

Peregrine falcon

Peregrine falcons occur throughout the state and are known to nest on the cliffs and trees along the Verde River. Both resident and nonresident populations occur throughout the drainage in suitable habitat. Although no peregrines are known from the immediate project area, the abundance of prey and the perennial water makes the Verde Valley a suitable location for peregrine foraging.

Mexican spotted owl

The Forest Service has formally consulted on nearly 200 timber sales and other projects in Arizona and New Mexico since August 1993. These projects have resulted in the anticipated

incidental take, in various forms, of 40 owls. In addition, the Bureau of Indian Affairs has consulted on one timber sale on the Navajo Reservation which resulted in an anticipated take of four Mexican spotted owls, and a highway reconstruction which resulted in the anticipated incidental take of two Mexican spotted owls. The Federal Highway Administration has consulted on one highway project that resulted in an undetermined amount of incidental take. No consultations on the spotted owl are known from this area. In general, migrating spotted owls may move to more open habitats at lower elevations (Ganey *et al.* 1992, Willey 1993) but no individuals are known to occur in this area.

Southwestern willow flycatcher

A total of 34 sites has been surveyed for southwestern willow flycatchers in the Verde River system since 1993 (Muiznieks *et al.* 1994, Sferra *et al.* 1995). These sites varied in size from small isolated habitat patches to the entire Verde River from Childs to Ister Flat. Of those surveyed areas, territorial willow flycatchers were detected at five locales. One bird was detected just above Horseshoe Reservoir in 1993, four to five males were detected at Camp Verde in 1994, one bird near Mescal Gulch just downstream of the proposed project in 1993, and two territorial singing males were found at the Tuzigoot Bridge, adjacent to the proposed project in 1993.

Ohmart (pers. comm.) discovered four pairs of flycatchers in 1992 at Clarkdale. The breeding status and reproductive success of those birds was not determined. In 1993, two pairs were present and one nest was documented. The nest contained a single cowbird nestling and eventually failed (Muiznieks *et al.* 1994). In 1994, two pairs and one unpaired male were present. Two nests were found, one of which successfully fledged two flycatchers, the other fledged a single cowbird (Sferra *et al.* 1995). Data from a more limited monitoring effort in 1995 indicate that two unpaired males occupied the Clarkdale site (Sogge 1995b). Surveys during the 1996 breeding season failed to detect any southwestern willow flycatchers at the Clarkdale site. However, one nesting pair of flycatchers was discovered at Tavasci Marsh approximately 2.4 km east of the Clarkdale site. Thus, although since its discovery the Clarkdale site has had only several pairs, cowbird parasitism and nest loss due to depredation resulted in poor reproductive success and may have been responsible for abandonment or extirpation at this site. No flycatcher were known to nest in the area during the 1997 breeding season (S. Plentovich, USFWS, pers. comm.).

The southwestern willow flycatcher is an insectivore, foraging within and above dense riparian vegetation, taking insects on the wing or gleaning them from foliage (Wheelock 1912, Bent 1960). No information is available on specific prey species. However, fecal samples containing identifiable invertebrate body parts were collected during banding operations from more than 70 southwestern willow flycatchers in California, Arizona, and southwestern Colorado (M. Sogge, USGS, pers. comm.). These samples could yield important data on prey use at various locations and timing throughout the breeding season.

Critical Habitat

Final critical habitat for the southwestern willow flycatcher includes approximately 90 miles (145 km) of the Verde River, from Sob Canyon downstream to Horseshoe Reservoir including Tavasci Marsh. The constituent elements which provide the physical and biological features necessary to sustain the species include the riparian ecosystem above the water's surface or within 100 meters of the water's edge. Constituent elements include riparian thickets of shrubs and small trees or areas where such vegetation may become established. Activities which may adversely modify such habitat include modifications which alter the quantity or quality of surface or subsurface water flow, food availability, or the general suitability of the site for nesting. Oil and grease has the tendency to remain on the water's surface creating hazards to avian life, and perhaps prey as well. During arid periods, when water levels are low, pooling of the runoff could create an attractive nuisance drawing birds to more concentrated pollutants.

Razorback sucker

The razorback sucker was a significant part of the historic fish fauna of the Verde River. Declines in the population were noted in the early part of the century, and the last fish to be recorded was taken from Peck's Lake in 1954 (Minckley 1973). In 1980, a memorandum of understanding was signed by Arizona Game and Fish Department and the Service to stock razorback suckers into the Gila, Salt, and Verde Rivers in an effort to restore the populations to those portions of the historic range. Early stockings were made with very small, juvenile fish and due to very high predation rates on the released fish by resident non-native fish species, were considered largely unsuccessful. In recent years, larger fish (approximately 250 millimeters total length) have been used instead to reduce predation risks. The stocking program and its results was recently reviewed (Hendrickson 1993). Stockings were made throughout the Verde River including portions of the river in the project area. Recaptures have been made in most stocking locations, mostly soon after the stocking took place, generally in pools or other sheltered habitats (Hendrickson 1993).

Using telemetry, habitat use by the larger stocked razorback suckers in the Verde River has been studied. Razorback suckers tend to move downstream after release. Larger fish did not move as much from the stocking site as did smaller fish (Clarkson *et al.* 1993). Deeper water areas in the river, sand bottomed substrates and lower velocities were selected proportionately higher than their occurrence in the system (Clarkson *et al.* 1993).

The population of razorback suckers in the Verde River is probably very small. The stocking of sub-adults in recent years has improved survivorship of stocked fish. As these fish mature, it would be expected that spawning areas would be selected in suitable habitats within the Verde River. The location of such areas is difficult to predict, but could occur anywhere the proper substrates are available. Backwaters and shallow nearshore areas could provide nursery habitat for young fish. Predation would continue to be a problem for survival of young razorback suckers.

Critical Habitat

The Verde River and its 100-year floodplain through the project area was designated as critical habitat for the razorback sucker. Not all lands within the designated boundaries are considered to meet the criteria for critical habitat, that is, meeting one or more of the constituent elements that were deemed essential to species conservation. Constituent elements include water, physical habitat, and biological environment. Additional selection criteria were developed during the designation process to address the special needs of the razorback sucker. These criteria were: (1) the presence of known or suspected wild spawning populations; (2) areas where juvenile razorback suckers had been collected or which could provide suitable nursery habitats; (3) areas presently or historically occupied that had the potential for establishment of a population; (4) areas required to maintain rangewide distribution under a diversity of physical, chemical and biological conditions; and (5) areas in need of special management to provide for the survival and recovery of the razorback sucker. Historic conditions in the Verde River have been altered by water and land uses in the watershed. Suitable habitat for all life stages of razorback sucker appears to be present.

It is in the area of biological environment that the Verde River, like most rivers within the historic range of the razorback sucker, has significant deficiencies. The lower portion of the Verde River, which includes the project area, is dominated by non-native fish species that have been implicated in the declines of the razorback sucker populations throughout the historic range. In addition, the introduction of these non-native fish species is likely also responsible for the introduction of the parasitic copepod *Lernaea* to the river. The presence of this copepod may have an effect on the survival of sub-adult and adult razorback suckers (Clarkson *et al.* 1993).

EFFECTS OF THE ACTION

Direct and Indirect Effects

During construction, approximately 540 acres (218 ha) will be rough graded. Activities included during the construction period include clearing and grubbing the site; construction of the tailings cap; grading of roads and the residential areas into parcels; construction of a permanent water storage reservoir, trenched (underground) utility lines, temporary and permanent effluent storage ponds, and a new lake outlet structure; grading and landscaping the golf course, and landscaping of primary access roads.

The construction of roads and buildings requires the use of hazardous materials such as petroleum products, pesticides, herbicides, small amounts of metals and other toxic materials which may be toxic to fish and wildlife. Storm water runoff is to be directed away from the disturbed areas during construction. Temporary berms, earth dikes, and sediment basins should limit the discharge of sediment and pollutants from the site.

Once completed, many chemicals are used in urban activities, and some of these chemicals may accumulate on surfaces and in sediments, or run off from impervious surfaces. When storms occur these chemicals and sediments may be flushed from streets, parking lots, and rooftops.

These flushes could produce surges of toxic stormwater that are discharged into streams and lakes (Lopes and Fossum 1995). Pollutants from golf course runoff includes nitrate, phosphate, and potassium. Structural and non-structural controls may be used to prevent or minimize pollutants from entering watersheds. Sand filters will be constructed to detain and treat storm water runoff volumes equivalent to a 2-year, 24-hour storm event. Storm water runoff greater than the 2-year, 24-hour event will be bypassed directly to the receiving waters. In areas of commercial parking lots, oil/water separators will be provided on storm drains instead of sand filtration systems.

Reasons for collected the 2-year, 24 hour runoff is based on the "first flush" phenonmenon which assumes that the majority of pollutants that accumulate on paved surface during dry weather will quickly be washed off during the beginning of the storm. In one study in Austin, Texas, the first flush phenonmenon did not occur. The first flush phenonmenon appears to be most pronounced in sites that are highly impervious. This same study determined that other pollutants such as nitrate, copper, other-phosphorus, and bacteria, the first flush was weak or altogether absent (Watershed Protection Techniques 1994).

Changes in the watershed that affect the quality and quantity of runoff have the potential to affect fish and wildlife. The combined effect of high volume storm water discharges and rapid stream velocities may increase pollutant loads and the ability of discharges to erode the land and carry pollutants, resuspend pollutants to slower flowing water bodies where pollutants may accumulate, and the increase the likelihood for stream channelization, and subsequent need for installation of concrete walls, riprap, or other modification projects.

Non-structural source controls, such as street sweeping, drain labeling, curbside recycling, education, and pesticide and nutrient management will be established in the Verde Valley Ranch development to reduce the potential for storm water pollutants. With the non-structural components and the reductions resulting from sand filter treatment, the estimated pollutant loads for an average year of rainfall are estimated below in Tables 1, 2, and 3.

Storm water runoff will receive treatment of retention basins and sand filters. However, the efficiency of sand filters is variable. On-lot retention basins are designed to accommodate the 2-year, 24-hour storm. Information in the SWPPP summarizes the efficiency of sand filters.

Most of the information was obtained from the City of Austin. Oil and grease removal rates are based on total suspended solids treatment by sand filters.

Constituent	Percent removed by sand filters
Sediment	70
Total phosphorus	33
Total organic carbon	48
Total Kjeldahl nitrogen	46
Biological oxygen demand	70
Trace metals	45
Oil and grease	60
Phosphorus	0

Table 1. Estimated Pollutant Load (in pounds) for Tavasci Marsh for Average Annual Rainfall Pre, During, and Post development

Pollutant	Pre-development	During Grading	Post-development
Biological Oxygen Demand	323.88	0.00	201.33
Chemical Oxygen Demand	1,306.88	0.00	2,252.20
Total suspended solids	9,148.15	0.00	2,338.45
Total Lead	1.70	0.00	0.73
Total Copper	1.59	0.00	0.72
Total Zinc	1.19	0.00	2.68
Total Kjedahl nitrogen	56.82	0.00	62.23
Nitrite/Nitrate	10.23	0.00	30.68
Phosphorus	10.80	0.00	16.38
Oil and Grease	0.00	0.00	84.38
Potassium	0.00	0.00	12.79

Table 2. Estimated Pollutant Load (in pounds) for the Verde River for Average Annual Rainfall Pre, During, and Post development

Pollutant	Pre-development	During Grading	Post-development
Biological Oxygen Demand	88.84	24.50	94.65
Chemical Oxygen Demand	358.47	98.84	817.77
Total suspended solids	2,509.28	691.91	1,330.53
Total Lead	0.47	0.13	0.32
Total Copper	0.44	0.12	0.31
Total Zinc	0.33	0.09	0.99
Total Kjeldahl	15.59	4.30	24.14
Nitrite/Nitrate	2.81	0.77	7.21
Phosphorus	2.96	0.82	4.37
Oil and Grease	0.00	0.00	31.75
Potassium	0.00	0.00	0.00

Table 3. Estimated Pollutant Load (in pounds) for Peck's Lake for Average Annual Rainfall Pre, During, and Post development

Pollutant	Pre-development	During Grading	Post-development
Biological Oxygen Demand	3,100.49	2,698.75	3,102.87
Chemical Oxygen Demand	12,510.75	10,889.67	15,673.96
Total suspended solids	88,575.24	76,227.72	76,974.12
Total Lead	16.32	14.20	15.47
Total Copper	15.23	13.26	14.53
Total Zinc	11.42	9.94	15.76
Total Kjeldahl nitrogen	543.95	473.46	601.89
Nitrite/nitrate	97.91	85.22	147.26
Phosphorus	103.35	89.96	122.66
Oil and Grease	0.00	0.00	192.85
Potassium	0.00	0.00	23.36

Urbanization increases imperviousness of the land which alters the natural vegetation and infiltration characteristics of watersheds. Increased levels of imperviousness alters natural flow patterns of wetlands, replaces natural vegetation, and causes less infiltration of rainfall to recharge ground water supplies, thereby lowering the water table (EPA undated). In addition to the decrease in infiltration, after the development high flow volumes may result in high erosion rates or flooding.

Under current conditions, the 2-year runoff is approximately 7.3 acre-feet for Tavasci Marsh, 1.4 acre feet for the Verde River, and 85.6 acre feet for Peck's Lake. The 25 year runoff volume is 16.5 acre-feet for Tavasci Marsh, 3.2 acre-feet for the Verde River, and 189.0 acre-feet for Peck's Lake. The 100 year runoff volume is 24.0 acre-feet for Tavasci Marsh, 4.5 acre-feet for the Verde River, and 269.3 acre-feet for Peck's Lake. In the post development conditions all these rates will increase as follows. The 2-year runoff will be approximately 9.1 acre feet for Tavasci Marsh, 1.7 acre-feet for the Verde River, and 92.1 acre-feet for Peck's Lake. The 25 year runoff volume will be 21.9 acre-feet for Tavasci Marsh, 3.8 acre-feet for the Verde River, and 207.5 acre-feet for Peck's Lake. The 100 year runoff volume will be 31.2 acre-feet for Tavasci Marsh, 5.3 acre-feet for the Verde River, and 294.6 acre-feet for Peck's Lake. The 2-year, 24 four sand filters will capture only the smallest, pre-construction floods allowing all other water to enter the watershed untreated. Information on the efficiency of increasing the size or number of treatment basins is not known.

The length of time pollutants from storm water discharges remain in a receiving water body depends on the duration of the storm event, the size of the watershed, flow rates in the receiving water, and the tendency for pollutants to accumulate in bottom sediments. Receiving waters with slower flows, like Peck's Lake and Tavasci Marsh, may be affected for a long period of time. Larger waterbodies, like the Verde River, are likely to receive a discrete pulse of pollutants, which quickly pass downstream, and are likely to be short-term. Long-term water quality impacts associated with storm water may also be from pollutants accumulating in the watershed or from repeated exposures to pollutants from numerous events.

Biological oxygen demand is an indicator of biodegradable organic matter and measures the oxygen demanding substances that can be metabolized by bacterial. Chemical oxygen demand (COD) is an indicator of both organic and reduced inorganic chemicals. COD measures oxygen demanding substances that react with an oxidizing chemical in a heated acid bath. Storm water runoff may contain both organic and inorganic pollutants that consume oxygen in receiving waters. The impacts of oxygen demanding pollutants may be more dramatic in shallow, slow moving waters due to limited aeration and the tendency of these pollutants to accumulate in sediments of slow moving water (EPA undated). The impact of the other pollutants, lead, copper, zinc, nitrate, nitrite, and phosphorus, individually or in combination are not known. All estimated discharges would, however, be within the Arizona surface water quality standards.

Nutrient loading is directly related to the frequency of runoff events in a developed watershed. High quantities of nitrogen and phosphorus from residential and commercial areas lead to eutrophication or excess growth of algae and aquatic macrophytes.

Bald eagle

The nature of the storm water runoff will change after the development is constructed and may affect the bald eagle prey base. Currently rain runs off open space. With the housing development rain will continue to flow over open space, but also over residential areas and the golf course. King *et al.* (1991) report that fish used by bald eagles collected in the Verde River contained elevated levels of cooper, chromium, mercury, nickel, selenium and zinc. Washing of pavement areas, leakage from vehicles, pesticides, fertilizers, and other hazardous substances may enter storm drains. Pollutants, such as antifreeze, waste oil containing heavy metals, and construction materials, may enter storm water runoff and accumulate over time so that exceedances of ambient water quality standards may occur in the water column or bioaccumulate in fish affecting the bald eagle prey base.

Peregrine falcon

The presence of rivers, riparian habitat, or other surface water may be a feature in determining the presence of an adequate food supply and peregrine falcons in the project area. Food items used by peregrines, other birds, such as shorebirds, pigeons, doves, may also be affected by storm water runoff, but the success of peregrines in urban areas suggest that the impacts will not be significant, except for the discovery of use of organochlorine pesticides which contributed to the peregrines demise. Any peregrines found in the area are likely transit and will not be significantly adversely affected by this project.

Mexican spotted owl

Mexican spotted owls are widely distributed and use a variety of habitats. These owls most commonly nest and roost in mixed-conifer forests dominated by Douglas fir and/or white fir and canyons with varying degrees of forest cover and also nest and roost in ponderosa pine-Gambel oak forest, where they are typically found in stands containing well-developed understories of Gambel oak. These areas are absent from the project area and the Mexican spotted owl is not likely to be impacted by this project. In general, migrating spotted owls move to more open habitats at lower elevations (Ganey *et al.* 1992, Willey 1993) and consume a variety of prey including small and medium sized rodents, bats, birds, and reptiles. Although prey for the spotted owls may occur in the project area, no spotted owls individuals are known to occur in this area the species is not likely to be significantly affected by the project.

Southwestern willow flycatcher and Critical Habitat

Open water, cienegas, marshy seeps, or saturated soil are typically in the vicinity of flycatcher territories and nests; flycatchers sometimes nest in areas where nesting substrates were in

standing water. However, hydrological conditions at a particular site can vary remarkably here in the arid Southwest within a season and between years, particularly during drier years, water or saturated soil is only present early in the breeding season (i.e. May and part of June). However, the total absence of water or visibly saturated soil has been documented at several sites where the river channel has been modified (e.g. creation of pilot channels), where modification of subsurface flows has occurred (e.g. agricultural runoff), or as a result of changes in river channel configuration after flood events (Spencer *et al.* 1996).

The Tavasci Marsh and Peck's Lake wetland type habitats will receive storm water runoff in the project area. Wetlands can slow water flows and remove pollutants. These flows may alter existing wetland ecosystems used by the southwestern willow flycatcher. Persistent toxics may accumulate in sediments, vegetation, and the food chain. Oil and grease discharged into areas used by the southwestern willow flycatcher may also affect the species and its prey. Birds can be affected by petroleum through external oiling, ingestion, and habitat changes. Petroleum can be ingested through feather preening, drinking, consumption of contaminated food, or evaporating oil. Ingestion of oil is seldom lethal, but can cause debilitating sublethal effects.

Riparian habitat is spatially dynamic. Habitat currently suitable in one site may be rendered unsuitable by human or natural causes. Food resources for the willow flycatcher may also be altered by polluted waters. In some areas, waters grossly polluted with organic matter have a restricted invertebrate fauna including only those species capable of thriving in areas of very low concentrations of oxygen and high concentrations of dissolved and particulate organic matter (Pennak 1978). Any habitat deterioration reduces areas for a species to carry out its life cycle and increases the probability of extinction of local breeding areas.

Effects analyses for critical habitat must determine if the proposed action would destroy or adversely modify critical habitat. "Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 CFR 402.02). The primary constituent elements identified as necessary for the survival of the southwestern willow flycatcher in the final critical habitat rule are:

1. Space for individual and population growth
2. Food, water (seasonal wetland), air, light, minerals, and other nutrients or physiological requirements
3. Cover or shelter
4. Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal, and
5. Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of the species

Among the activities identified in the final rule that may adversely modify critical habitat are: 1) activities that remove, thin, or destroy riparian vegetation by mechanical, chemical (herbicides or burning), or biological (grazing) means, 2) any activities which alter the quantity or quality of surface or subsurface water flow, 3) destruction/alteration of the species' habitat by discharge of fill material, draining, ditching, tilling, pond construction, and stream channelization, 4) excessive use of riparian areas and uplands for livestock use, and 5) development of recreational facilities and off-road vehicle operation. The rule finds that excessive use of riparian areas and uplands by livestock may affect the volume and composition of riparian vegetation, may physically disturb nests, may alter floodplain dynamics such that regeneration of riparian habitat is impaired or precluded, and may facilitate brood parasitism by brown-headed cowbirds.

Adverse effects on constituent elements or segments of critical habitat generally do not result in adverse modification determination unless that loss, when added to the environmental baseline, is likely to result in significant adverse effects throughout the species' range, or appreciably lower the capacity of the critical habitat to support the species. The frequency and magnitude of pollutants discharged into this critical habitat will modify the area from natural runoff to low density urban runoff. While the stormwater plan will reduce the amount of suspended solids (TSS), other parameters nitrite/nitrate and oil and grease are expected to increase. These parameters while singularly high are considered a fraction of the total flow through the area. Nonetheless, discharges from this project are expected to meet all Arizona Water Quality standards including the narrative standard which states "Naviagable waters shall be free from oil, grease and other pollutants that float as debris, foam, or scum; or that cause a film or iridescent appearance oth the surface of the water, or that cause a deposit on a shoreline, bank or aquatic vegetation" (ADEQ 1996b).

Based on the magnitude of effects to the critical habitat for the southwestern willow flycatcher including the Verde River, Peck's Lake, and Tavasci Marsh from the proposed action, such an action is not likely to destroy or adversely modify the proposed critical habitat.

Razorback sucker and Critical Habitat

The creation of a storm water system will modify the drainage of areas used by the razorback sucker. High turbidity levels may be associated with accelerated erosion, bank de-stabilization, channel cutting, metals transport, and associated sediment transport. Increases in the volume and intensity of runoff may increase the frequency of local flooding and create unstable stream banks. This may result in narrower and deeper streambanks than those of undisturbed watersheds. Although adapted to large rivers, razorback suckers actually use specific types of habitat within the river. Fast water, rapids and shallow riffles are not preferred. Pools, side channels, mid-channel bars, backwaters and flooded bottomlands are more preferred. Spawning habitats are gravel/cobble bars or beaches. Nursery areas include backwaters and flooded bottomlands. Nearshore shallow waters and backwaters are likely to provide habitat for young razorback suckers in the future. The stocking of sub-adult fish provides opportunity for establishment of spawning populations under current conditions. Effects to the constituent

elements and special selection criteria are related to the preceding discussion of effects to the species. Although the historic conditions in the Verde River have been altered by water and land uses in the watershed, the river continues to have flows and physical habitat conditions that are suitable for the development of a razorback sucker population. Changes in normal flooding in the Verde River which modifies flooded bottomlands may be important to young fish. The decrease in suspended solids (TSS) may make young fish more vulnerable to predation. Suitable habitat for all life stages appears to be present. Changes to the physical habitat will affect various life stages, reducing the opportunity for bank stability, influencing sediment loads, and reducing the opportunity for areas required to maintain rangewide distribution under a diversity of physical, chemical and biological conditions. Erosion of stream banks may limit the availability of adjacent floodplains which are used by native fishes including the razorback sucker.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of ESA.

Implementation of the Phelps Dodge Corporation and the Town of Clarkdale's Tailings Closure and New Wastewater Treatment Plant will be completed with this project. The Aquifer Protection Permit issued by the Arizona Department of Environmental Quality requires the Town of Clarkdale to discontinue disposing of effluent on the tailings pile, and cap the pile with a high density polyethylene liner to prevent further seepage into Pecks Lake or the Verde River. The life of the liner is only guaranteed for 20 years. A groundwater pumpback system will extract and pump contaminated groundwater into an effluent storage pond located at the Verde Valley Ranch. The effluent will be used to irrigate the new golf course. This purpose of this pumping is to lower the water table so that leaks or seepage of the contaminated ground water through the filter does not reach the shallow aquifer. Pumping will occur at a rate of 216,000 gallons per day. It is not known if the lowering of the water table will affect the immediate riparian ecosystem. ADEQ requires monitoring of the quality of the groundwater pumped from the from the shallow aquifer. In a hearing to review an appeal to the Aquifer Protection Permits for this project, the Office of Administrative Hearings determined "no evidence exists... to conclude that appropriative rights of any upstream or downstream Verde River water rights holder are or will be affected by the grant of these permits" (ADEQ 1995).

Additional changes to the existing uses on private lands and facilities within the project area are not anticipated within the near term. In the future, additional river uses, developments, and changes to diversions and use of water are very likely to occur as a result of urbanization in the Verde Valley and changes to other non-Federal actions. The magnitude of these changes is not clear at this time.

SUMMARY

The combined effects likely have a considerable influence on the flows and flow patterns of the Verde River, the sediment loads, and storm water runoff which will affect the riparian restoration capability in the reach and the resident animal community dependent upon the river. Further complicating the analysis is the topography of the reach itself, which for most of the length is not conducive to establishment of extensive stands of riparian vegetation.

CONCLUSION

After reviewing the current status of species of concern, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the bald eagle, southwestern willow flycatcher or razorback sucker, is not likely to adversely affect peregrine falcon or Mexican spotted owl, and is not likely to destroy or adversely modify designated critical habitat for the razorback sucker or southwestern willow flycatcher. No critical habitat has been designated for the bald eagle, peregrine falcon, or Mexican spotted owl, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

AMOUNT OR EXTENT OF TAKE

The Service has determined that the storm water permit for this project would result in incidental take of bald eagles, razorback suckers, and southwestern willow flycatcher. The incidental take is expected to be in the form of harm.

Take of bald eagles will be difficult to determine due to the wide home range of nesting birds, and the transitory nature of migrating and wintering birds. Chemical contamination is not likely to result in direct toxicity but in lesser health effects such as reproductive failure. Reproductive

failure can also be attributed to seasonal fluctuations, existing vulnerability of the bald eagle in the Verde Valley, and a number of factors throughout the species' range.

The small size of the razorback sucker population in the Verde River makes any estimate of take very difficult to make. Take in the action area is the result of effects of the proposed action and the effects of upstream watershed and river conditions, further complicating the analysis. In addition, take downstream of the proposed action area is influenced by effects of the action.

Take of the southwestern willow flycatcher will result from degraded watershed conditions and riparian health and will likely occur over time. Groundwater pumping and pollutant discharges may limit existing and future willow flycatcher habitat.

Because the type and extent of take for this proposed action is difficult to define and measure, the Service has determined that a surrogate measure is needed to define the take and when it has been exceeded. The Service concludes that incidental take for the bald eagle, razorback sucker, and southwestern willow flycatcher from the proposed action will be considered to be exceeded if the following condition is met:

> The monitoring data indicate a trend that demonstrates the decline in water quality conditions as compared to the projected mean pollutant concentrations estimated in the proposed Storm Water Pollution Prevention Plan.

The Service does not anticipate the proposed action will incidentally take any peregrine falcons or Mexican spotted owls.

If, during the course of the action, the amount or extent of the incidental take anticipated is exceeded, the Federal action agency must reinitiate consultation with the Service immediately to avoid violation of section 9. Operations must be stopped in the interim period between the initiation and completion of the new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species, as required by 50 CFR 402.14(i). An explanation of the causes of the taking should be provided to the Service.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to any species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. EPA has a continuing duty to regulate the activity covered by this incidental take statement. If the EPA (1) fails to require

the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize take for the bald eagle, razorback sucker, and southwestern willow flycatcher:

Each phase of the development of this project contains best management practices to minimize the transport of pollutants to receiving waters of Pecks Lake, Tavasci Marsh, and the Verde River. Full implementation of the storm water management program (both during and after construction) shall not result in a trend in the decline of water quality conditions as compared to the mean pollutant concentrations estimated in the SWPPP.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of ESA, the EPA (in coordination with Phelps Dodge) must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

To implement the reasonable and prudent measure:

1. Conduct stormwater monitoring as specified in the SWPPP, including all monitoring and maintenance requirements. Track the frequency and magnitude of measured levels which exceed the predicted mean concentrations used in the SWPPP. Measured levels are not expected to meet or exceed predicted means because of the added benefits from the implementation of non-structural controls.

2. Evaluate receiving water monitoring data that are higher than the Arizona Water Quality standards and if the data indicates that the permittee is causing or contributing to the exceedance, the permittee shall conduct an investigation to determine the source of the pollutants. Determination of the permittee to be contributing to any exceedances will be made by evaluating the nature of the exceedance, constituent concentrations of Verde River diversions and stormwater runoff from Verde Valley Ranch, and other germane factors. Consideration will be given to the fact that the Peck's Lake watershed includes all of the Verde River drainage upstream of the diversion structure and that 85 % of the area that drains directly to the lake is not within Verde Valley Ranch or owned by the Phelps Dodge Corporation.

3. Measure the actual contaminants of organics and metals to soil particles. Monitoring will be accomplished using the Monitoring Plan found in the SWPPP prepared by Woodward Clyde. This portion of the Monitoring Plan should be modified to add sediment samples from Tavasci Marsh, and the Verde River.

4. Conduct visual inspections to indicate evidence of a violation of the Arizona Surface Water Quality narrative standards, particularly for oil and grease. Visual inspections will be conducted eight times a year for the life of the permit. If visual inspections are satisfactory for 5 consecutive years, monitoring may be reduced to four times a year.

5. Report the results of the monitoring to the Service annually, including complete and accurate records of implementation of Terms and Conditions #1-4.

If any of the above mentioned conditions result in a violation of water quality standards, the permittee shall conduct the following steps: 1) within 60 days, initiate an investigation to determine the source of the violations; 2) evaluate potential necessary modifications to the stormwater management program; 3) before the next reporting period, implement any necessary modifications to the stormwater management program; 4) continue to evaluate alternatives to sand filter treatments; 5) if modifications of the stormwater management program fails to correct the violation or if repeated violations occur within 1 year, initiate plans for structural and nonstructural modifications to the stormwater management program.

Notice: To the extent that this statement concludes that take of any threatened or endangered species of migratory bird will result from the agency action for which consultation is being made, the Service will not refer the incidental take of any such migratory bird for prosecution under the MBTA of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions specified herein.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of ESA directs Federal agencies to utilize their authorities to further the purposes of ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Coordinate with the Service and the Arizona Game and Fish Department on a project to re-introduce the Page springsnail, *Pyrgulopsis morrisoni*, a candidate species for consideration for listing under the Endangered Species Act, into Tavasci Marsh.

2. Conduct a literature review to acquire, review, and summarize information on the toxic effects of newly paved asphalt as it may relate to the Verde River watershed.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

CONFERENCE REPORT

Colorado squawfish

In 1985, a determination for an experimental non-essential population of Colorado squawfish in the Verde River was published by the Service. Colorado squawfish have been stocked into the Verde River under this designation in the twelve years since. Although the Colorado squawfish is listed as an endangered species throughout its range, an experimental non-essential population does not have the full protection of sections 7 or 9 of ESA. This allows for more flexibility in management of the area containing the population. Experimental non-essential populations are considered, for the purposes of section 7, as if they were only proposed for listing as a threatened species.

Life history information for the Colorado squawfish was summarized in the biological support document for the designation of critical habitat (Maddux *et al.* 1993). The following information is abstracted from that document.

The Colorado squawfish was historically found in the large rivers of the Colorado River Basin. It was listed as an endangered species in 1967 under a precursor to the current ESA. The largest minnow in North America, reaching lengths of nearly two meters, the Colorado squawfish preyed on the other native fish species in the basin. Significant spawning migrations are also characteristic of this species. Spawning takes place on the declining water levels of late spring and early summer in riverine habitats associated with whitewater canyons. Adults utilize all types of riverine habitats, including pools, eddies, backwaters and main channel habitats. Young Colorado squawfish are flooded bottomlands and other ephemeral embayments and backwaters.

Conclusion

Effects to the Colorado squawfish are not significantly different from those described under the effects section for razorback sucker either in magnitude or type. Formal conference is required

when an action is likely to jeopardize the continued existence of a species proposed for listing. Based on the magnitude of effects to the Verde River from the proposed action, such a finding is not warranted for the Colorado squawfish.

Thank you for your continuing efforts to conserve listed species If we can be of further assistance, please contact Debra Bills or Ted Cordery. Please refer to consultation number 2-21-94-F-309 in future correspondence concerning this project.

Sincerely,

Sam F. Spiller
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque NM (ES)

Director, Arizona Game and Fish Department, Phoenix AZ
Director, Arizona Department of Environmental Quality, Phoenix, AZ (Attn: R. Wilson)

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